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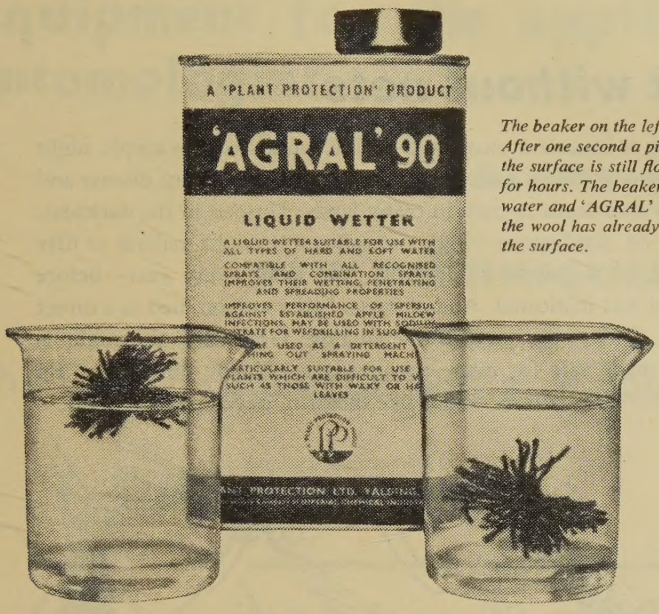

The beaker on the left contains water only. After one second a piece of wool placed on the surface is still floating—and will float for hours. The beaker on the right contains water and 'AGRAL' 90. After one second the wool has already sunk one inch below the surface.

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TESTS WITH 'AGRAL' IN JAMAICA

Trials in Jamaica with 'Agral' LN show that it greatly improves the control of banana leaf spot *(Cercospora musae)* by 'Perenox'. The fungicide was applied high volume and plants were sprayed to 'run off'. The table below shows the effectiveness of this treatment.

TREATMENT	PERCENTAGE OF 'PERENOX' IN SPRAY FLUID	MEAN NUMBER OF SPOTS PER LEAF	
		April 26th	May 20th
'PERENOX'	0.25	12	109
'PERENOX'+ 'AGRAL' LN	0.25+ 15 CC/100 LITRES	0.5	39

Spray dates: 9th March, 30th March, 20th April.

'Agral' LN has also been used successfully for the control of potato blight with 'Perenox', the control of apple mildew with 'Spersul', and with sodium nitrate and sodium arsenite weedkillers.

The same remarkable results would have been achieved by using 'AGRAL' 90 at *one third* the volume.

Formulating new spray chemicals is only part of the Plant Protection service to farmers and growers. Continuous research on fungicides, insecticides and weedkillers is being carried out at the Fernhurst Research Station, backed by the immense resources of the parent company, Imperial Chemical Industries Ltd.

GARDNER (J. C. M.) & EVANS (J. O.). **Notes on *Oemida gahani* Distant (Cerambycidae). Part II.**—*E. Afr. agric. J.* **22** no. 4 pp. 224–230, 7 figs. Nairobi, 1957.

Further observations in East Africa on *Oemida gahani* (Dist.) and closely related Cerambycids [*cf. R.A.E.*, A **44** 67] showed that the only species of the group of economic importance other than *O. gahani* was *Androeme plagiata* Auriv., which was found to be common in logs of *Juniperus procera* and dead wood in the West Usambara Mountains of Tanganyika. Characters are given differentiating the adults and larvae of *O. gahani* and *A. plagiata*. *O. gahani* was found to be more widely distributed than was previously known [*cf. loc. cit.*], having been further observed in dry wood in the extreme west of Uganda and in stumps, logs and dead wood of various species in northern, central and southern Tanganyika. It has also been collected in Southern Rhodesia and near Durban in South Africa, this being the only record from a low-lying area.

Continued observations on the bionomics of *O. gahani* showed that the shortest life-cycle [*cf.* **44** 68] lasted 14–15 months, in moderately moist *Cupressus*, and that 1,515 adults emerged over six years from 3·25 cu. ft. of *Lagunaria* wood that already showed many emergence holes before caging. It appears that an adult that completes its development in living *Cupressus* cannot emerge from the tree unless the pupal chamber lies beneath an externally evident dead-wood scar; emergence holes have never been observed in living sapwood. Difficulties in estimating the incidence of attack in plantations are discussed. From an examination of cross-cut sections of logs from 300 *Cupressus* trees, 18 per cent. of the latter were estimated to have been attacked, but subsequent examination of the sawn planks showed the actual percentage to have been 34. No attack on healthy pines has been recorded, and attempts to infest *Pinus* spp. with larvae of *Oemida* failed, apparently owing to the copious flow of resin. It is emphasised, however, that pine logs or sawn timber are not immune from attack.

Investigations on pruning in plantations are in progress. Early pruning, before the formation of heartwood, would lessen the risk of attack both because the scars, through which *Oemida* gains access, would be small, and because suitable feeding zones for the larvae would be lacking. Examination of various plantations of *Cupressus* showed that *Oemida* was absent from those trees or parts of trees that had never been pruned, and it appears that the abolition of pruning might at least partly prevent infestation. Recommendations are made for the treatment or disposal of affected timber. Structural timbers of *Podocarpus*, *Cupressus* and *Pinus* should receive early treatment, pressure impregnation being suitable. Though *Podocarpus* is at present the principal timber attacked, other species, including hardwoods, may also prove susceptible. Such infestation does not necessarily originate in the forest.

DUFFY (E. A. J.). **A Monograph of the immature Stages of African Timber Beetles (Cerambycidae).**—10 × 7¼ ins., vii + 338 pp., frontis., 10 pls., 219 figs., 18½ pp. refs. London, Brit. Mus. (Nat. Hist.), 1957. Price £5 5*s*.

This volume, which is the second of a proposed series on the Longicorns of the world [*cf. R.A.E.*, A **41** 299], is concerned with those of the whole of Africa, Madagascar, Mauritius, Réunion, Rodriguez and the Seychelles. Some 200 genera and 400 species, including all those of major economic importance, are dealt with; those from northern Africa were for the most part discussed in the previous volume, but additional information is given for some of them. The information on the species resembles that in the first

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volume in scope and treatment and is based on the literature and original observations in the laboratory and field. It comprises descriptions of the immature stages, many of which are described for the first time, together with notes on the bionomics and, for economic species, summaries of control measures where available and brief descriptions of the adults of the most important ones. Keys are given to the larvae of 137 genera and 203 species and to the pupae of 61 genera and 83 species; a catalogue of the plants attacked, showing the species that infest each, is included.

Hogan (T. W.) & Barber (I. A.). **The Common Field Cricket. Experiments with new Control Methods.**—*J. Dep. Agric. Vict.* **53** pt. 12 pp. 544–546, 3 figs. Melbourne, 1955.

Acheta commodus (Wlk.) [*cf. R.A.E.*, A **44** 333] is an important pest of pastures in the black-soil districts of southern Victoria, and also attacks cereal and vegetable crops during outbreaks. A bran bait containing BHC is recommended for control, but it is relatively useless against the young crickets and its effectiveness varies with the availability of food. In laboratory tests of insecticides, dieldrin and, to a less extent, aldrin and γ BHC as lindane were more effective than chlordane, DDT or toxaphene, and dusts of these three materials were accordingly tested in experimental plots in 1955. The insecticides were incorporated in superphosphate, BHC by mixing and dieldrin and aldrin by being first dissolved and then sprayed on to it, and each was applied at rates of 4, 8 and 16 oz. in 1 cwt. per acre on 21st February. The results were estimated by counting the surviving crickets that congregated under bags placed on the plots for the purpose, the counts being made on 3rd and 28th March, 14th April and 4th May. Dieldrin and aldrin at 16 oz. per acre reduced mean population from 13·92 for no treatment to 5·65 and 7·61 per plot, respectively, and dieldrin at 8 and 4 oz. and aldrin at 8 oz. reduced it to 8–9, but the other treatments were ineffective. The mortality from the more persistent insecticides (aldrin and dieldrin) apparently did not increase with time, but such an effect may have been masked by migration of crickets to the treated plots. Dieldrin and aldrin also gave highly satisfactory control in two fields to which they were applied by the grower at 8 oz. per acre.

Morris (D. S.). **Orchard Mite Control. The new Acaricides.**—*J. Dep. Agric. Vict.* **53** pt. 12 pp. 551–555, 558, 4 figs., 1 ref. Melbourne, 1955.

Bryobia praetiosa Koch and *Tetranychus telarius* (L.) (*urticae* Koch) are the most important mites on fruit trees in Victoria, the former occurring mainly on apple, pear and almond and the latter on peach and cherry. Both have increased since the introduction of DDT sprays against orchard pests, and *B. praetiosa* has also been favoured on apple by the substitution of organic fungicides for lime-sulphur, which is a good acaricide. In consequence, severe damage occurs early in the season. Field tests were therefore carried out in 1954–55 to discover more effective materials for dormant applications against *B. praetiosa* and safer ones than parathion [*cf. R.A.E.*, A **39** 99] for summer use against both mites. Against the overwintering eggs of *B. praetiosa* on apple, the standard sprays of red oil (1:20) and superior-type oil [*cf.* **31** 12] (1:33) and an emulsion spray containing 0·55 per cent. PCPBS (p-chlorophenyl benzenesulphonate) applied on 13th August 1954, two weeks before hatching began, gave excellent protection until early January 1955, after which populations increased rapidly. Sprays of 0·05 per cent. wettable Ovotran (p-chlorophenyl p-chlorobenzenesulphonate) or

Chlorparacide (p-chlorobenzyl p-chlorophenyl sulphide) were of little value. Infestation by the woolly aphis [*Eriosoma lanigerum* (Hsm.)] increased greatly on trees sprayed with materials other than oil, and a spray of γ BHC as lindane was necessary in December to control it.

Summer sprays against *B. praetiosa* were tested on apple trees of a variety particularly susceptible to attack, on which infestation in late November was sufficiently severe, despite a dormant application of oil, to warrant treatment. Parathion and malathion were tested in emulsion sprays at 0·01 and 0·05 per cent., respectively, and Chlorparacide, PCPBS and Ovotran at 0·05 per cent.; applications were made on 29th November. All the materials, especially parathion and malathion, caused significant reductions during the first week, but only Chlorparacide, PCPBS and Ovotran gave commercial control for eight weeks, and a second application was necessary in February. Two applications of Ovotran made a month apart on a neighbouring block of trees prevented any serious increase during the latter part of the season. None of the sprays damaged the leaves or fruits. Similar results were obtained when the same five materials were applied on 17th November against *B. praetiosa* on pear trees that had received no winter sprays; infestation was less heavy than on apple and one application of Ovotran, PCPBS or Chlorparacide gave adequate protection until harvest.

T. telarius overwinters on and near the trees in the adult stage and causes heavy damage to peach foliage from December onwards, especially in hot, dry weather. In a test on control, the five sprays tested against *B. praetiosa* and an emulsion spray of 0·03 per cent. Aramite (2-chloroethyl 2-(p-tert.-butylphenoxy)-1-methylethyl sulphite) were applied on 12th January and again on 8th February 1955 to peach trees that had been heavily infested during the previous two years. Chlorparacide gave the best initial control, but only Aramite was satisfactory at the end of a further six weeks, and two applications of this material gave excellent protection until 16th March, when the test was concluded.

Edwards (B. A. B.) & Shedley (D. G.). **White Wax Scale** (*Ceroplastes destructor* **Newstead). The Evaluation of Control Methods, the Use of organic Insecticides and Scale Distribution on** *Citrus* **Trees in Western Australia.**—*J. Dep. Agric. W. Aust.* (3) **4** no. 5 pp. 549–550, 553–554, 557–559, 3 figs., 5 refs. Perth, W.A., 1955.

In experiments in 1952 on the control of *Ceroplastes destructor* Newst. on *Citrus* in Western Australia, sprays of white oil (1:40) alone or with the addition of anhydrous sodium carbonate (4 oz. per gal.) [*cf. R.A.E.*, A **39** 290] were applied to Valencia orange trees on various dates, and the results were assessed by counting the scales on twig samples in October. The best control was given by a single thorough application of the soda spray made on 23rd April, at the late peak stage [when the crawlers have settled in their permanent positions but their scales are still pointed], which reduced the mean populations from 251 per sample to four, or two of white oil alone, made on 9th January, 14 days after the main emergence of the crawlers, and again a fortnight later, which reduced them to five. These treatments were significantly superior to single thorough or light applications of the soda spray applied on 27th February, at the early peak stage, and to one white-oil spray on 9th January, alone or followed by the soda spray at half the concentration (2 oz. per gal.) on 27th February, though all treatments gave significant control. Little spray damage occurred, as the temperature did not exceed 90°F. Statistical analysis of populations showed that the Coccids were significantly less numerous on the lower portions of the trees than on the upper ones and on the western than on the other three sides of the trees,

on which they were equally numerous. In a small-scale trial on navel orange, sprays of 0·5 per cent. chlordane, aldrin or dieldrin applied on 9th January gave little control.

Lowe (A. D.). **Control of Grasshoppers damaging a Field Crop.**—*N.Z. J. Agric.* **92** no. 2 pp. 111, 113–114, 3 figs., 1 ref. Wellington, N.Z., 1956.

Severe damage was caused in January 1955 to young turnips at Orton, in the South Island of New Zealand, by *Phaulacridium marginale* (Wlk.), a grasshopper that is common on dry pastures, along roadsides and in waste areas. Infestation had spread from adjacent old, dry pasture, and the grasshoppers destroyed all the vegetation in their path, including weeds. A Gryllid, *Lissotrachelus maoricus* (Wlk.), was also present in considerable numbers, but was not injurious. After preliminary tests, three areas in the affected field were treated with wettable-powder sprays giving 8 oz. lindane [almost pure γ BHC], 4 oz. aldrin and 1 lb. p,p′-DDT per acre, respectively, and a fourth was left untreated. The products were each applied in 10 gals. water per acre from a tractor-drawn mist-sprayer having a lateral fan giving a 40 ft. swathe at right angles to the line of travel. The total numbers of grasshoppers taken in 200 sweeps of the net were 101 before treatment, 12, 1, 0 and 78 after three days for DDT, BHC, aldrin and no treatment, respectively, 11, 4, 1 and 105 after ten days, and 4, 2, 0 and 14 after 28 days. The corresponding figures for *L. maoricus* were 7, 0, 0 and 15 after three days, 13, 15, 0 and 13 after ten days, and 1, 1, 0 and 2 after 28 days. Aldrin, which was the most effective, was also the cheapest of the insecticides, and its seems likely that satisfactory control could be obtained with as little as 2 oz. per acre. The products used are highly toxic to honey bees and other pollinating insects, and should not be applied to crops or pastures in flower, or in the vicinity of hives.

Coste (R.). **Les caféiers et les cafés dans le monde. Tome premier. Les caféiers.**—[5 +] 381 pp., 74 pls., 106 figs., many refs. Paris, Éditions Larose, 1955.

This volume contains a chapter (pp. 233–318) in which P. Vayssière reviews the animal pests of coffee throughout the world. Insects comprise the great majority, and information varying in scope and detail with their importance is given on their distribution, bionomics and control, including natural enemies. Mites are dealt with similarly, and a note on the pests of stored coffee and another on insecticides and their uses are included.

Schwerdtfeger (F.). **Die Waldkrankheiten. Ein Lehrbuch der Forstpathologie und des Forstschutzes.** [Forest Diseases. A Textbook of Forest Pathology and Forest Protection.]—2nd edn. (revd.), 10 × 6½ ins., 485 pp., 199 figs., many refs. Hamburg, P. Parey, 1957. Price *DM.* 39.40.

This is a new edition of a book on the pathology of forest trees in Germany, of which an earlier shortened version has been noticed [*R.A.E.*, A **38** 382]. The text is divided into seven main parts, of which the first is introductory and the second deals with damage due to fire, smoke, weather and unfavourable soil conditions. The third comprises a survey of the various pathogenic organisms injurious in forests, over 100 pages being devoted to insects. The information given on these relates to their morphology, bionomics, food-plants and control, with references to the more important literature on them.

Outbreaks and their causes are also considered. The fourth part is concerned with the natural resistance of trees to pests and diseases, and the fifth and sixth with the biological and economic consequences of attack. The last part deals with protection and control and includes a survey of the chemical measures available against insect pests.

Muesebeck (C. F. W.). **Two new Parasites of the Yellow Clover Aphid and the Spotted Alfalfa Aphid (Hymenoptera: Braconidae).**—*Bull. Brooklyn ent. Soc.* **51** no. 1 pp. 25–28, 6 figs. Lancaster, Pa., 1956.

Descriptions are given of the adults of both sexes of the Braconids, *Trioxys utilis* and *Praon palitans*, spp. n. *T. utilis* was reared in Italy and France from Aphids thought to be the spotted alfalfa Aphid [*Myzocallis maculata* (Buckt.)], for which the author uses the name *Pterocallidium* sp., and the yellow clover Aphid, *Myzocallis* (*Pterocallidium*) *trifolii* (Monell), respectively, and also from *M. trifolii* in Kentucky and Nebraska. *Praon palitans* was reared from *M. maculata* in Italy, Israel and Yugoslavia and from *M. trifolii* in France and Kentucky. Both parasites are now being reared in the United States for release in areas infested by these Aphids.

Compere (H.). **An Appraisal of Silvestri's Work in the Orient for the University of California, some Misidentifications corrected, and two Forms of *Casca* described as new Species.**—*Boll. Lab. Zool. Portici* **33** pp. 35–47, 13 refs. Portici, 1956.

In the course of this paper, the author corrects errors that were made in the identification of Aphelinids of the genus *Casca* received in California from Silvestri in 1924–25 as parasites of *Chrysomphalus* spp. Two species referred to as *Casca chinensis* How. in subsequent papers [*R.A.E.*, A **15** 249; **24** 802] are described as *C. smithi*, sp.n., and *C. silvestrii*, sp.n., respectively. The former is recorded from *Chrysomphalus* sp. in Canton, China, and the latter from *C. bifasciculatus* Ferris in Sydney, New South Wales. The true *Casca chinensis* cannot be identified with certainty, owing to the poor condition of the type specimens. It is recorded from *Aonidiella aurantii* (Mask.) in Canton, and the distinguishing characters of the female are given. The other new species described is *C. wanhsiensis*, which was reared from *A. aurantii* on pomelo in Szechuan, China; it differs from *C. chinensis* only in coloration. A key to the females of eight species of *Casca* is appended.

Flanders (S. E.). **Hymenopterous Parasites of three Species of oriental Scale Insects.**—*Boll. Lab. Zool. Portici* **33** pp. 10–28, 2 figs., 19 refs. Portici, 1956.

Notes are given on the bionomics of 20 species of introduced parasites and one hyperparasite studied in the laboratory at Riverside, California, in connection with work on the biological control of *Aonidiella aurantii* (Mask.), *A. citrina* (Coq.) and *Lepidosaphes beckii* (Newm.) on *Citrus*. Since about 1940, *Comperiella bifasciata* How., *Habrolepis rouxi* Comp., *Aphytis* A [since described as *A. lingnanensis* Comp. (*R.A.E.*, A **44** 368)] and *Prospaltella perniciosi* Tower have been reared and released against *Aonidiella aurantii*, and the first also against *A. citrina*, and *Aphytis* X [since described as *A. lepidosaphes* Comp. (*loc. cit.*)] and *Physcus* B against *L. beckii*; all have become established. *Casca wanhsiensis* Comp. [*cf.* last abstract], *Aphytis* B, *Prospaltella* P, *Aspidiotiphagus citrinus* (Craw) and *A. louns-*

buryi (Berl. & Paoli) have also been released, but establishment did not occur or remains uncertain.

Muesebeck (C. F. W.). **Some Braconid Parasites of the Pink Bollworm** *Pectinophora gossypiella* **(Saunders).**—*Boll. Lab. Zool. Portici* **33** pp. 57–68, 7 figs. Portici, 1956.

The seven parasites of *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) described, all from adults, are *Apanteles imitandus* and *A. parkeri*, spp.n., from Brazil, *A. angaleti* [*cf. R.A.E.*, A **45** 196] and *Petalodes gossypiellae*, spp.n., from India, *Orgilus gossypii* and *Chelonus liber*, spp.n., from Argentina, and *Meteorus graciliventris*, sp.n., from Japan. *A. haywardi* Blanch. is recorded from *Platyedra gossypiella* in Brazil; it was not previously known to attack this host. The work was undertaken in connection with the introduction of certain parasites from southern Asia into Texas for release against *P. gossypiella* on cotton there.

De Bach (P.). **Relative Efficacy of the Red Scale Parasites** *Aphytis chrysomphali* **Mercet and** *Aphytis* **"A" on** *Citrus* **Trees in southern California.**—*Boll. Lab. Zool. Portici* **33** pp. 134–151, 1 fig., 5 refs. Portici, 1956.

The following is based largely on the author's summary. *Aphytis chrysomphali* (Merc.) and *Aphytis* A [since described as *A. lingnanensis* Comp. (*R.A.E.*, A **44** 368)], which parasitise *Aonidiella aurantii* (Mask.) on *Citrus* in southern California [*cf.* **39** 235], were studied in 1949–53 under conditions in which they competed with each other in the field. When equal numbers of each species were liberated in adjacent plots of infested *Citrus* from which parasites had previously been absent, *Aphytis lingnanensis* spread and within a year constituted over 80 per cent. of the parasite population in the plots in which *A. chrysomphali* had been released, and when it was liberated only during an initial period, in plots in which *A. chrysomphali* was already well established, it generally became the dominant species within a year and it constituted an average of 95 per cent. of the total parasite population in all plots after four years. The numbers released influenced the rate at which *A. lingnanensis* attained dominance, but even when fewer than 100 females were released per tree it formed about 50 per cent. of the total parasite population after a year. There were no striking differences in the relative success or proportion of the two species in the coastal, intermediate or interior climatic areas, and the rate of spread of *A. lingnanensis* from release sites averaged about ten rows of trees per year, though the population in the tenth row was small.

In laboratory studies on the bionomics of the two species, 50 per cent. of the adults of *A. lingnanensis* and (in brackets) *A. chrysomphali* died in 7 (4), 12 (8), 11 (3), 6 (3) and 4 (1) days at temperatures of 50, 60, 70, 80 and 90°F., and the numbers of days required for development from egg to adult at 50 per cent. relative humidity for the two species, respectively, were 54 and 45 at 60°F., 22 and 22 at 70°F., and 15 and 14 at 80°F.; at 90°F., *A. lingnanensis* developed in 13 days, but the eggs of *A. chrysomphali* failed to hatch. At 80°F. and 60 per cent. relative humidity, the numbers of eggs laid per female averaged 57·1 and 13·2, respectively, and the numbers of hosts destroyed by adult feeding [*cf.* **42** 77] 45·9 and 22. The factors that would favour *A. lingnanensis* in the field include its greater length of adult life and fecundity, its greater destruction of the host by adult feeding, and the greater resistance of the eggs to high temperatures, but others are also probably involved.

Gambaro (P.). **L'ibernazione di** *Quadraspidiotus perniciosus* **Comst. e i suoi rapporti con il clima.** [The Overwintering of *Q. perniciosus* and its Relation to Climate.]—*Boll. Lab. Zool. Portici* **33** pp. 255–272, 6 graphs, 30 refs. Portici, 1956.

Further investigations on *Quadraspidiotus perniciosus* (Comst.) on fruit trees in northern Italy in 1946–53 confirmed previous observations that this Coccid survives the winter there only in the first instar [*cf. R.A.E.*, A **37** 457; **43** 201]. All stages were present during the summer, but there was a progressive reduction from early October in the numbers of individuals other than those in the first instar. The adult females were the most resistant of these and survived for part of the winter if the temperatures were not too low, but none survived until spring. In the laboratory, all stages except the settled first-instar nymphs were killed by exposure to −5°C. [23°F.] for 20 days. The overwintering first-instar nymphs found in the last third of October were of either the second or the third generation of the year, and their size varied accordingly. The first instar lasted 20–22 days in June (when the average daily temperature was 22–23°C. [71·6–73·4°F.]) and eight days in July (when it was 25–27°C. [77–80·6°F.]). In the laboratory, it lasted 35–36 and 6–7 days at 18 and 28°C. [64·4 and 82·4°F.], respectively. Nymphs of the second generation that appear in September and those of the third are subject in the field to average daily temperatures not exceeding 20°C. [68°F.] and are therefore unable to develop sufficiently to complete their first moult before winter. However, development continues slowly throughout the cold season, the rate varying with the temperature. Overwintered nymphs were considerably larger at the time of the first moult than were examples that developed at other times of the year.

Delucchi (V.). **Note generali sui predatori di** *Dreyfusia piceae* **Ratz. e sui loro parassiti.** [General Notes on the Predators of *Chermes piceae* and their Parasites.]—*Boll. Lab. Zool. Portici* **33** pp. 283–302, 8 figs., 17 refs. Portici, 1956.

The author lists the ten predators of *Chermes* (*Dreyfusia*) *piceae* Ratz. collected on *Abies alba* during investigations begun in 1950 in Switzerland, Germany and France to discover natural enemies suitable for introduction against that Aphid in Canada [*cf. R.A.E.*, A **42** 199], and gives notes on their bionomics and on the parasites that attack each. The information on the four species despatched in 1951–53 has been noticed from more detailed sources [**42** 199, 250, 280; **45** 239]. A fifth, *Leucopis* (*Leucopomyia*) *obscura* Hal., had already been introduced into Canada in 1933 against *C. piceae* and is well established [*cf.* **42** 263]. One of the parasites that attack *L. obscura*, *L. griseola* (Fall.) and *Cremifania nigrocellulata* Czerny in Europe was recently described [**45** 239] as *Pachyneuron ferrièrei* by the author [who subsequently proposed a new name, *P. vitodurense*, for it, as the name selected earlier was preoccupied (*cf.* **28** 510)]. In Canada, *L. obscura* is parasitised by *P. altiscutum* How.

Zimmerman-Gries (S.) & Swirski (E.). **La diffusione degli afidi sulle patate in Israele.** [The Distribution of Potato Aphids in Israel.]—*Boll. Lab. Zool. Portici* **33** pp. 303–311, 1 graph, 10 refs. Portici, 1956. (With a Summary in English.)

The following is based on the authors' summary. The main virus diseases of potato in Israel are mild mosaic (mottle), Aucuba mosaic, leaf-drop

streak, leaf-roll and rugose mosaic, the last being the most widespread. Since Aphids are important vectors of potato viruses, studies were undertaken in 1951–53 to investigate the species present on the crop in the coastal plain, the northern Negeb and the hill districts. Potatoes are planted in November–January, February–March and August–September, and harvested in March–April, May–July and November–January, respectively, so that plants are always present from January to July and from September to November.

The most abundant Aphid was *Myzus persicae* (Sulz.). Maximum numbers were taken in March 1952, in the coastal plain, when 39 per cent. of the plants were infested and there were 183 individuals per 1,000 plants. *Aphis fabae* Scop., which is common on other plants in Israel, was found only once on potato. Small colonies of *Macrosiphum* (*Acyrthosiphon*) *pisum* (Harris), *Aphis gossypii* Glov. and another Aphid closely related to the latter were also found on the plants, and *Trifidaphis phaseoli* (Pass.) was observed, on two occasions, on the roots. Alates of other Aphids occurred on potato, but no colonies were produced.

Murbach (R.). **L'évolution des populations du hanneton commun, *Melolontha melolontha* L. (Col. Scarab.) dans quelques prairies naturelles de la vallée du Rhône à la suite d'opérations de hannetonnage chimique.**—*Boll. Lab. Zool. Portici* **33** pp. 365–376, 3 figs., 11 refs. Portici, 1956. (With a Summary in Italian.)

Since grassland only lightly infested by larvae of *Melolontha melolontha* (L.) has been considered the most prolific source of adults of that cockchafer, denser populations suffering high mortality [*cf. R.A.E.*, A **43** 26–27], it appeared that large-scale control of the adults by means of insecticides might cause an actual increase in subsequent numbers. The relation between larval population density and mortality was therefore investigated in 1950–53 in meadows situated in the Rhône Valley in Switzerland. The results, which are given in detail, confirmed that mortality increases with population density, though the increase was not linear. Mortality was low and varied little for populations of 10–15 second-instar larvae per sq. metre, but exceeded 90 per cent. for those of 50 per sq. m. These variations tended to equalise final population densities. It is concluded that campaigns against the adults are likely to have a stabilising effect on populations, preventing them from rising above a high but non-critical level.

Binaghi (G.). **Su uno sviluppo massivo ed eccezionale di *Haltica saliceti* Wse. (Col. Chrys.) a carico della quercia (*Quercus robur* L.). (Morfologia ed etologia dei vari stadi.)** [On a massive and unusual Outbreak of *H. saliceti* on Oak. (Morphology and Bionomics of the various Stages.)]—*Boll. Lab. Zool. Portici* **33** pp. 493–512, 11 figs., 13 refs. Portici, 1956.

In 1954, a severe outbreak of *Haltica saliceti* Weise, which usually attacks willows (*Salix*), occurred on oaks (*Quercus robur*) on the coast to the east of Genoa; all stages of this Halticid are described, and its distribution is reviewed from the literature. On 30th May, many leaves were found to have been damaged by the feeding of the adults and first-instar larvae on the upper and lower surfaces, respectively, and eggs were numerous on the lower surfaces, occurring mostly in groups of 5–11. Only larvae were present by 29th June, and parts of the foliage were drying up as a result of the continued feeding. Larvae taken to the laboratory, where the temperature averaged 22°C. [71·6°F.], began to pupate, just below the surface of the

soil in the cages, on 11th July, and the first adults emerged on 20th July. In the field, large numbers of adults were present on 1st August; about 80–82 per cent. of them were females, which were, however, not sexually mature. The adults fed for about two weeks, but almost all had left the trees by September. There appeared to be only one generation a year. Good control was given by a spray of lead arsenate and an adhesive, applied in early June, infestation being subsequently only sporadic on treated trees.

Servadei (A.). **Appunti sulla biologia dell'***Apion seniculus* **Kirby (V contributo alla conoscenza dell'entomofauna delle leguminose foraggere).** [Notes on the Bionomics of *Apion seniculum* (Fifth Contribution to Knowledge of the Insect Fauna of leguminous Fodder Plants).]—*Boll. Lab. Zool. Portici* **33** pp. 621–628, 6 figs., 16 refs. Portici, 1956.

In this further part of a series [*cf. R.A.E.*, A **39** 72, etc.], an account is given of observations on the bionomics of *Apion seniculum* Kby. on clover near Florence. There was only one generation a year, the overwintered adults resuming their activity in March and pairing after a short period of feeding on the leaves. The eggs were inserted singly into the stalks, usually close to the ground. Up to five eggs were found per stalk, and oviposition continued in some cases until the end of the first ten days of May. The larvae hatched in about a week and mined upwards. They became full-fed in about 45 days and pupated in the galleries. The pupal stage lasted about a week, and adult emergence continued from the second ten days of May to early July. The adult weevils fed on the leaves during the early summer, but became less active during very hot weather and sheltered among débris left in the fields after cutting. As the temperature fell to 10°C. [50°F.], they left the clover and overwintered round the edges of the fields, beneath leaves, grass or stones.

The damage caused was severe where the clover was growing under moist conditions, both the quantity and the quality of the hay or seed being affected. The control measures recommended include the clearing of overwintering sites round the edges of the field, or the placing there of piles of dead leaves to attract the adults, which can then be destroyed. Cutting the crop as early as possible in spring is recommended, so that larvae are removed from the field before they complete their development. Treatment with insecticides is thought to be uneconomic.

Grison (P.). **Quelques aspects de la lutte microbiologique contre les insectes ravageurs des cultures.**—*Ann. Épiphyt.* **7** (1956) no. 4 pp. 543–562, 4 figs., 72 refs. Paris, 1957.

The author reviews work on the control of injurious insects by means of bacteria, with particular reference to the use of *Bacillus thuringiensis* against *Pieris brassicae* (L.) in France [*cf. R.A.E.*, A **45** 126, etc.], and discusses various aspects that need to be considered in such work, including the determination of the characteristics of a given bacillus, its effectiveness against particular species, the symptoms it produces, methods of culture and distribution, and the interpretation of the results obtained.

In laboratory tests, the Anduze strain of *B. thuringiensis* [*cf. loc. cit.*] was tested against various Lepidoptera, the larvae, all of which were at the beginning of the third instar, being confined on leaves sprayed with a suspension containing 200 million spores per cc. and applied to give 2·8 mg. per sq. cm. of leaf surface. The mortality percentages obtained (calculated according to Abbott's formula [**13** 331]), and (in brackets) the

number of days in which they were reached, were 92 (4) and 100 (6) for *Erannis* (*Hibernia*) *defoliaria* (Cl.), 93 (10) and 100 (17–18) for *Operophtera brumata* (L.), 77 (13–14) and 91 (17–18) for *Himera pennaria* (L.), 88 (6) and 100 (10) for *Thaumetopoea processionea* (L.), 95 (13–14) and 100 (17–18) for *Malacosoma neustria* (L.), 70 (13–14) and 87 (17–18) for *Euproctis chrysorrhoea* (L.) (*phaeorrhoea* (Don.)), and 16 (10) and 18 (13–14 and 17–18) for *Lymantria dispar* (L.).

Bonnemaison (L.). **Possibilités d'emploi des insecticides endothérapiques en vue de la protection des plantes contre les maladies à virus.**—*Ann. Epiphyt.* **7** (1956) no. 4 pp. 563–640, 16 graphs, 124 refs. Paris, 1957.

Detailed accounts are given of numerous tests carried out in the field, greenhouse and laboratory in northern France since 1951 on the effectiveness of the systemic insecticides, demeton [diethyl 2-(ethylthio)ethyl phosphorothioate], schradan, and Isolan [1-isopropyl-3-methyl-5-pyrazolyl dimethylcarbamate] for the control of Aphids on field-crop and other plants and the protection of beet from virus yellows and of potato from various Aphid-borne virus diseases. Contact insecticides, mostly parathion, were used for comparison, and observations are recorded on the flight periods of the Aphids concerned. The following is based on the author's conclusions.

Immersing seeds of broad beans [*Vicia faba*], sugar-beet seedlings or potato or *Dahlia* tubers in liquids containing various amounts of schradan, demeton, Isolan or parathion did not give satisfactory protection against infestation by *Aphis fabae* Scop. and sometimes proved phytotoxic. Several tests were made with sprays against *Myzus* (*Myzodes*) *persicae* (Sulz.) and *Brevicoryne brassicae* (L.) on crucifers, *M. persicae* on potato and *A. fabae* on beans. The systemic materials were less effective against *M. persicae* than against *B. brassicae*, and the alates were more susceptible to all four materials than were the apterae. Mortality of the Aphids was never complete, and it did not begin for several hours after they had been placed on plants treated with the systemic insecticides, the delay increasing with the interval between treatment and exposure. Schradan was less effective when applied to the soil by watering than when used in sprays.

Though *M. persicae* is a more efficient vector of beet yellows, *A. fabae* is present in the beet-growing areas of France in much greater numbers and was the chief vector in the area investigated. Populations of *A. fabae* developed early and infested the plants in the seedling stage, such early attacks being particularly severe in dry springs. In areas where beet is grown for seed, migrants from the seed crop, which is frequently affected by yellows, assured early infection of the root crop. Peach is rare in the area, but apterae of *M. persicae* overwinter, under mild conditions, on winter rape and cabbage; plants that are sources of infection (such as seed-beets, beets abandoned in the soil, or spinach) become infested in spring and alates from these colonies subsequently disseminate the virus among the root crop, but in this case infection is late. In some localities, where young root-crop plants were found growing close to beet clamps or winter spinach, infection was both early and extensive, resulting in considerable losses in yield.

Control of the Aphids on beet by sprays of the systemic insecticides was neither complete nor instantaneous, and as both *M. persicae* and *A. fabae* can transmit the virus almost immediately on becoming infective, the use of systemic materials cannot completely prevent primary infections, though it reduces the number of plants affected and consequently the spread of secondary infection. Its effect will be most apparent when the flight period is short and when the weather is warm and dry, so that growth of the plants

is slow and the effectiveness of the toxicants is retained for a longer period. Better results will generally be obtained by sowing early, since plants that were well developed at the time of the flight of the infective migrants appeared less attractive to them than did young ones, and by applying dusts of parathion or lindane [γ BHC], or a parathion spray, to control severe outbreaks of *A. fabae*. Systemic insecticides should be applied only when the root crop is close to an important source of infection and the presence of large numbers of alates of *M. persicae* ensures early dissemination of the virus, or to very late sowings. Seedlings for use in the following year can be obtained by sowing after 15th–20th July, and they can be protected from Aphids migrating from their summer food-plants in September–November by 1–3 applications of demeton between late August and mid-October.

M. persicae is the most effective vector of the viruses that infect potato in France, but *Aphis* (*Medoralis*) *nasturtii* Kalt. is also of importance near Paris. As on beet, treatment with systemic insecticides will only slightly reduce primary infection with viruses of the non-persistent type, but in the case of leaf-roll, which is of the persistent type and can be transmitted only after a period of at least 56 hours after acquisition by the vector, good results can be expected from treatments giving control of Aphids in less than that time [*cf. R.A.E.*, A **44** 409, etc.]. In greenhouse tests, complete kill of alates of *M. persicae* was given in 48 hours by parathion at 0·18 lb. and by demeton at 0·36 and 0·72 lb. per acre for up to eight days after treatment, and in a field test, demeton at 0·675 lb. per acre was effective against various Aphids on potato for up to 15 days. It is pointed out, however, that satisfactory results will be obtained only when the sources of infection are few and, in the case of seed potatoes, when the crop is at least ½ mile away from ware potatoes.

Grison (P.) & Silvestre de Sacy (R.). **L'élevage de *Pieris brassicae* L. pour les essais de traitements microbiologiques.**—*Ann. Épiphyt.* **7** (1956) no. 4 pp. 661–674, 6 figs., 30 refs. Paris, 1957.

A description is given of a technique developed in France for the mass rearing of *Pieris brassicae* (L.), undertaken to obtain a constant supply of experimental material, and problems involved in rearing this butterfly are discussed. Adults were kept in a portion of a greenhouse hung with muslin, and provided with young cabbage plants for oviposition and artificial flowers containing honey solution similar to those previously described [*R.A.E.*, A **41** 6]. In the absence of direct sunlight, light was provided for six hours daily by an incandescent lamp of 500–1,500 watts. The larvae were transferred to transparent plastic boxes having two openings covered with wire mesh, and were provided with cabbage leaves. In winter, continuous lighting was provided by a 40-watt incandescent bulb, and development was then not interrupted by a diapause. The larvae pupated either in the boxes or in wire-mesh cages, and the newly-emerged adults were transferred to the greenhouse. The durations of the larval instars at 25, 18–20 and 15°C. [77, 64·4–68, and 59°F.] were about 2–3, 3–4 and 4–7 days, respectively, for each of the first four instars, and 3–5, 7–9 and 11–15 days, respectively, for the fifth. At 18–20°C., the pupal stage lasted 9–11 days. The adults survived for 5–25 days, with an average of 17, and females that developed in December 1954 and February 1955 laid an average of 265 eggs each. The production of material for experimental purposes can be regulated by varying the temperature at which the eggs and larvae are kept; the eggs survived for 3–4 weeks at 10–12°C. [50–53·6°F.].

The chief problem in rearing *P. brassicae* lies in the exclusion of certain fungus, bacterial and virus diseases, which are reviewed from the literature

and scrupulous attention must be paid to the cleanliness of the cages and of all the materials used in rearing.

Burgerjon (A.). **Pulvérisation et poudrage au laboratoire par des préparations pathogènes insecticides.**—*Ann. Épiphyt.* 7 (1956) no. 4 pp. 675–684, 5 figs., 10 refs. Paris, 1957.

Details are given of a laboratory apparatus designed in France for the even application of pathogenic organisms in dusts or sprays to horizontal surfaces or to vertical objects such as twigs, for testing against insects. It consists essentially of a cylindrical tower of which the upper portion is inclined at an angle to the lower vertical part, so that the spray or dust is emitted at an angle below the horizontal. The tower stands in water, to give an airtight seal, a revolving plate at the base is of a size sufficient to accommodate 6–7 petri dishes, and the contaminated air from the tower is evacuated after the treatment and sterilised by a flame. The evenness of application obtained is illustrated by the results of special tests.

Hollings (M.). **Anemone Mosaic—a Virus Disease.**—*Ann. appl. Biol.* **45** no. 1 pp. 44–61, 1 pl., 17 refs. London, 1957.

The name anemone mosaic is proposed for a hitherto unrecorded virus disease found in *Anemone coronaria* in south-western England in 1953. It was common in that year and again in 1955, when incidence in some places approached 100 per cent. The commonest symptoms were mottling and distortion of the leaves and the presence of white splashes or malformation or both in the flowers, which were reduced in number and sometimes failed to open. Natural infection also occurred in Brompton stock (*Matthiola incana*) and *Ranunculus* sp., and in groundsel (*Senecio vulgaris*) and shepherd's purse (*Capsella bursa-pastoris*) growing in or near anemone fields. The virus was transmitted by inoculation to 47 of 90 ornamental plants, vegetables and weeds, and the symptoms caused are briefly described; four kinds of plants were invariably and three others usually symptomless carriers.

There was no transmission through the seed in small-scale experiments, and no evidence of transmission by soil. In tests with Aphids, the virus was transmitted between anemone, petunia, pe-tsai (*Brassica pekinensis*), tobacco, New Zealand spinach (*Tetragonia expansa*) and *Chenopodium amaranticolor* by *Myzus persicae* (Sulz.), and between some of these plants less frequently by *Macrosiphum* (*Aulacorthum*) *solani* (Kalt.), *M. solanifolii* (Ashm.) (*euphorbiae*, auct.) and *Brevicoryne brassicae* (L.), but no transmission was effected by *Myzus circumflexus* (Buckt.) or *M. ornatus* Laing. Apterae of *M. persicae* that were starved for three hours prior to feeding on infected plants for 2–3 minutes mostly ceased to be infective after 30 minutes when transferred serially to healthy plants. Similar Aphids that were confined in glass tubes between the infective and test feeds in general lost their infectivity within 90 minutes, though a few retained it for two hours. The virus is thus of the non-persistent type. Its physical properties are described, and its relation to similar viruses discussed.

The only control measures at present available are the removal of infected plants and weeds, the use of insecticides against Aphids and, possibly, the use of barrier crops. Kale is sometimes planted as a windbreak between rows of anemones; it is not infected by the disease, but is infested by both *M. persicae* and *B. brassicae*.

Govier (D. A.). **The Properties of Tomato Aspermy Virus and its Relationship with Cucumber Mosaic Virus.**—*Ann. appl. Biol.* **45** no. 1 pp. 62–73, 1 pl., 19 refs. London, 1957.

In further investigations in south-western England on the virus that causes a disease of chrysanthemum and is generally considered to be that of tomato aspermy [*cf. R.A.E.*, A **43** 280, etc.], though the relation of this to cucumber mosaic was uncertain, the aspermy virus was the only one detected in 346 plants of 78 cultivated varieties of chrysanthemum. The symptoms comprised stunting, which was usually slight, mottling and, in some varieties, distortion of the leaves, and various degrees of distortion and streaking of the flowers, which often failed to open completely. Two varieties could not be artificially infected, were not found infected in the field, and are believed to be resistant. Natural infection was found only in chrysanthemum, tomato and *Zinnia elegans*, but 22 other species in 15 genera [*cf.* **43** 269], including cucumber [*cf.* **38** 149] but not lettuce [*cf.* **43** 269], were found to be susceptible.

In tests on Aphid transmission, the virus was transmitted from chrysanthemum to chrysanthemum, tobacco and tomato by *Myzus persicae* (Sulz.) and by *Macrosiphum* (*Aulacorthum*) *solani* (Kalt.), and to the first two of these plants by *M.* (*Macrosiphoniella*) *sanborni* Gill., and from tomato to tomato and tobacco, and from tobacco to tobacco, by *M. solani* and *Myzus persicae*. One of ten tomato plants became infected after *Aphis fabae* Scop. from infected tomato had fed on them. No transmission was obtained with *Macrosiphum solanifolii* (Ashm.) (*euphorbiae*, auct.) [*cf.* **43** 280] or *Myzus ascalonicus* Doncaster. *Macrosiphum solani* was common on both chrysanthemum and tomato, but did not occur in dense colonies; it is probably mainly responsible for the spread of the virus between and within these crops. On tomato, the Aphids were distributed singly over all the aerial parts, but on chrysanthemum they were mostly on the under surfaces of the lower leaves. *M. sanborni* was less common but formed dense colonies on the stems, and is probably responsible for some spread within stocks of chrysanthemum. *Myzus persicae* appeared to be too rare on infected plants to be of importance.

The physical properties of the virus are described. In cross-protection tests, tomato-aspermy virus and one strain of cucumber mosaic protected against each other, but there was only partial protection between tomato aspermy and another strain of cucumber mosaic. It is concluded from these results and those of serological tests that the aspermy virus is a strain of the cucumber-mosaic virus.

Ossowski (L. L. J.). **The Biological Control of the Wattle Bagworm (*Kotochalia junodi* Heyl.) by a Virus Disease.—I. Small-scale Pilot Experiments.**—*Ann. appl. Biol.* **45** no. 1 pp. 81–89, 1 graph, 16 refs. London, 1957.

The larvae of *Kotochalia junodi* (Heyl.) on wattle (*Acacia*) in South Africa are attacked by a polyhedral virus disease of the nuclear type. Mortality due to it varies from year to year, but was recently observed to reach 25 per cent. in some plantations in Natal. Symptoms are not readily discerned, since the larvae are almost entirely enclosed in their bags, and are easily seen only in larvae that have passed the second instar. Early infection is sometimes characterised by light body colour, but in later stages the body becomes distended, black and flaccid at the hind end, emits a dark, foetid fluid, and may entirely disintegrate; sometimes part of the body becomes hard and brittle, finally breaking into particles, which probably disperse

through the plantation. Methods of isolating, purifying and storing the polyhedra are described, and an account is given of preliminary tests on the artificial dissemination of the disease by applying them in sprays.

When 50 newly hatched larvae were released on a tree 10 ft. high two hours after it had been sprayed with 100 ml. of a suspension containing 250,000 polyhedra per cu. mm., 44 of them were found after 20 days to have been killed by the disease, whereas only four of 50 released on an unsprayed tree died from it in the same period. In another test, 90 newly hatched larvae released on trees 2½ ft. high that were sprayed at the same rate and concentration on 24th October were all dead by 9th November; on similar unsprayed trees, only 29 had died by 16th January. Mortality began a few days after the application of the sprays. In an experiment with larvae 14 days of age, a spray containing 10,000 polyhedra per cu. mm. gave 88·4 per cent. mortality in a month, and there was little difference when the concentration was increased to 250,000 polyhedra per cu. mm.; dead larvae were first observed after 17 days. In a test of the persistence of the virus, 178 of 200 larvae, mostly in the third instar, that were placed on a tree sprayed two months earlier with a suspension containing 250,000 polyhedra per cu. mm. were killed by the disease within three months and the rest were destroyed by parasites and other causes. The polyhedra did not affect *Charitopimpla sericata* (Krchb.) (*Philopsyche abdominalis* Morl.) and *Carcelia cvolans* (Wied.), which parasitise the larvae, and were not washed off the trees by heavy rain, and they are therefore likely to give good control if applied before the larvae hatch. As disintegrating larvae, which are thought to be mainly responsible for the carry-over of the disease from one season to another, remain in the bags for over a year, an artificial introduction of the virus is likely to keep a population in check for several years. Its failure to exert control unaided is probably due to its natural scarcity and uneven distribution and to the lack of mobility in the larvae.

Harlow (P. A.). **The Toxicity of DDT in abrasive and non-abrasive Dusts to the Rice Weevil,** *Calandra oryzae* **L. (Coleopt., Curculionidae).**— *Ann. appl. Biol.* **45** no. 1 pp. 90–113, 6 figs., 34 refs. London, 1957.

The following is based on the author's summary. The toxicity to *Calandra oryzae* (L.) of dusts of DDT in some 20 different carriers was determined by confining batches of 50 adults in 6-in. tubes of filter paper, each containing a few grains of wheat that were shaken with 0·18 gm. dust, which was sufficient to ensure excess coverage of the insects. The concentration of DDT was 5 per cent. or less, exposure was usually for about 28 hours, the temperature was mostly 25°C. [77°F.], and mortality was assessed as the number of weevils incapable of movement when placed on a warmed glass plate. At high relative humidity (95 per cent.), the toxicity of the DDT was not affected markedly by any diluent except charcoal. Dusts diluted with this showed an initial reduction in toxicity during the first four days, but there was no further reduction over four months; the edges of DDT crystals in contact with charcoal at room temperature became emarginated, after a month, owing to sorption. The loss of toxicity may be due in part to the translocation of DDT to the inner surface of the charcoal, but a reduction in the concentration of DDT vapour in the air surrounding the dust may be a critical factor [*cf. R.A.E.*, A **42** 332], and it is suggested that although DDT must be accumulated on the insect to be effective against it, most of it vaporises before entering the cuticle. Small differences in the toxicity of DDT caused by other carriers could not be accounted for by differences in their average particle size, bulk density, surface area, abrasiveness to insects, or effect on the behaviour of or the amount that adhered to the insect. At

low relative humidity (50 per cent.), abrasive dusts killed the insects by desiccation, thus adding to the toxic effect of DDT. Abrasion of the cuticle did not affect the apparent rate of penetration of DDT at either humidity [*cf.* **38** 307, etc.]. Weevils kept without food before treatment were more susceptible to DDT poisoning, and abrasive carriers increased toxicity in some experiments by preventing them from feeding.

MacCuaig (R. D.). **The cumulative Toxicity of γ-BHC and Diazinon applied in small Doses to Locusts.**—*Ann. appl. Biol.* **45** no. 1 pp. 114–121, 2 graphs, 7 refs. London, 1957.

The following is virtually the author's summary. The toxicity of γ BHC and Diazinon (O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl phosphorothioate) when applied over a period of time to adults of *Schistocerca gregaria* (Forsk.) was determined. The insecticides were applied in oil solutions, by means of a micro-drop syringe, to the ventral surface of the abdomen. When doses were applied in two equal portions with a 72-hour interval or in four equal portions at 24-hour intervals, no significant decrease in toxicity, in comparison with a single dose, could be detected with either insecticide. It is concluded, therefore, that if similar effects occur when locusts are sprayed with these insecticides in the field, successive spraying will be fully cumulative over a period of 72 hours. Less favourable results had been obtained with DNC [*R.A.E.*, A **45** 318]. The sexes were similar in resistance to γ BHC when the doses were measured in μg. per gm. body weight, but females were considerably more resistant to Diazinon than males.

Stokes (B. M.). **Observations and Experiments on the Hessian Fly (*Mayetiola destructor* Say).**—*Ann. appl. Biol.* **45** no. 1 pp. 122–132, 2 figs., 11 refs. London, 1957.

The food-plants and some aspects of the bionomics of *Mayetiola destructor* (Say) were investigated at Rothamsted during 1953–55 with adults reared from puparia collected locally on *Agropyrum repens*, wheat [*Triticum vulgare*], barley and rye and their progeny. Cross-breeding experiments with adults that developed on these plants and *Triticum turgidum* showed that *M. destructor* was the only species present [*cf. R.A.E.*, A **42** 357; **44** 194]. The progeny of parents from *A. repens* developed successfully on wheat, rye, *Aegilops ovata*, *T. compactum*, *T. dicoccoides*, *T. durum*, *T. spelta* and *T. turgidum*. Individual females moved successively to plants of different species oviposited on all of them, and progeny developed successfully on some; furthermore, succeeding generations were able to breed on food-plants other than those on which they were reared. In limited experiments, females oviposited but larvae did not become established on oats (*Avena sativa*), *T. aegilopoides*, *T. dicoccum*, *Hordeum murinum*, *A. fatua*, *A. ludoviciana* and several other grasses. Some evidence was obtained that wheat was a more favourable food-plant than *Agropyrum repens*, and more adults were reared on young plants than on old. Parasites reared from the puparia comprised *Trichacis didas* (Wlk.), a species of *Eupteromalus* thought to be *E. hemipterus* (Wlk.), and unidentified species of *Platygaster*, *Chrysocharis* and *Tetrastichus*.

There were three main flights a year, in May and early June, in July–August, and in September–October, and the generations showed considerable overlapping. Puparia collected at the same time did not always give rise to adults during the same flight. In the laboratory, the maximum and minimum developmental periods for the overwintering generation were 283

and 243 days, respectively, and the maximum development period for individuals of other generations was 395 days. The seasonal and developmental history of the Cecidomyiid was similar to that observed in the United States, and the failure of *M. destructor* to become of economic importance in Britain is attributed to control exerted by standard farming practices. In addition to unfavourable conditions created by rotation of crops, the overwintering generation is reduced by the early removal of self-sown wheat, the late sowing date for winter wheat, and the eradication of *A. repens*, and the midsummer generation is restricted because the wheat is usually too far advanced to be favourable for larval development when the overwintered females are ovipositing. There are also differences in the wild food-plants available in the two countries.

HEATHCOTE (G. D.). **The Comparison of yellow Cylindrical, Flat and Water Traps, and of Johnson Suction Traps, for sampling Aphids.**—*Ann. appl. Biol.* **45** no. 1 pp. 133–139, 12 refs. London, 1957.

The following is based partly on the author's summary. Traps of four different types in southern England were compared with respect to their suitability for the quantitative study of the Aphid vectors of plant viruses. All except the suction trap were painted a bright yellow. In 1952, a Moericke water trap [*cf. R.A.E.*, A **39** 359] caught more Aphids than a flat adhesive trap of equal area. In 1953, a flat adhesive trap 930 sq. cm. in area caught half as many Aphids as a cylindrical adhesive trap [**38** 355] with an area of 945 sq. cm., and the latter caught about one-third as many as a Moericke water trap 1,200 sq. cm. in area or a Johnson suction trap with a 9-inch fan [**38** 296], all situated at a height of 2–3 ft. over bare soil. The total numbers of Aphids caught by the water and suction traps were of the same order of magnitude, but there were differences in the numbers of the individual species [*cf.* **44** 411]. The water trap caught more of *Aphis fabae* Scop. and *Myzus persicae* (Sulz.), but fewer of *Brevicoryne brassicae* (L.), than did the suction trap, but it caught more of all these three species than the adhesive traps.

It is concluded that attraction by colour influences the catch on horizontal traps more than on cylindrical ones because there is less impaction by the wind. Only suction traps indicate the number of Aphids per unit volume of air and are non-selective, but they are expensive and require an electric power supply. Water traps effectively catch those Aphids that are attracted to yellow, but they require frequent attention. Adhesive traps catch fewer Aphids than either suction or water traps, but they can be left unattended for about two weeks. Flat adhesive traps catch Aphids likely to land on a crop, and cylindrical traps show when Aphids are in the air, but not whether those Aphids are able or wanting to land. For routine work, cylindrical adhesive traps have other advantages; they are cheap and do not require skilled handling, and their catches of alates of *M. persicae* have been shown in work already noticed to be correlated with the spread of some plant viruses [*cf.* **38** 295; **41** 307].

MCINTOSH (A. H.). **Particle Size of insecticidal Suspensions and their Contact Toxicity. VI. Effect of Temperature on relative Toxicity.**—*Ann. appl. Biol.* **45** no. 1 pp. 189–205, 33 refs. London, 1957.

The following is based almost entirely on the author's summary of this part of a series [*cf. R.A.E.*, A **43** 404, etc.]. Two aqueous suspensions, one containing crystals of uniform size and the other containing colloidal particles, were made with each of seven solid contact poisons, comprising

DDT, two analogues of it (1,1-bis(p-ethylphenyl)-2,2-dichloroethane [ethyl-DDD] and 1,1-bis(p-chlorophenyl)-2-nitropropane), rotenone, 2-bromomercurithiophen, dieldrin and endrin. The relative toxicity of each pair of suspensions was found by dipping or measured-drop tests on adults of as many as possible of the three species, *Oryzaephilus surinamensis* (L.), *Tribolium castaneum* (Hbst.) and *Tenebrio molitor* L. In addition, some tests were made by injection of colloidal suspensions of DDT, dieldrin and endrin into the last two species. In each test, some insects were kept after treatment at 28°C. [82·4°F.] and others at 11, 17 or 20°C. [51·8, 62·6 or 68°F.], and mortality counts were made after 24 hours.

In the contact tests, the colloid was nearly always more toxic than the crystals. In all the tests except those with dieldrin, the relative toxicity (colloid : crystals) was greater at the lower after-treatment temperature, and the temperature coefficient of the relative toxicity was therefore negative; in the case of dieldrin, it was positive. DDT, its analogues, rotenone and endrin were more toxic at the lower after-treatment temperature, and their temperature coefficients of kill by contact action were therefore negative; in all five compounds, these temperature coefficients were greater for the colloid than for the crystals. Dieldrin and 2-bromomercurithiophen had positive temperature coefficients of kill by contact action, but whereas with dieldrin the coefficient was greater for the colloid than for the crystals, the reverse was true of 2-bromomercurithiophen. The temperature coefficient of kill by injection was negative for DDT, but positive for dieldrin and endrin.

A possible explanation for the results of the contact tests is given in an appendix. It is based on a number of assumptions about the penetration of insect cuticle by solid poisons, of which the most important are that the poison is first dissolved in the epicuticular wax layer, that it must saturate the wax layer locally before any insect dies, and that if mortality counts are made quite soon after treatment, the mortality caused by a fixed dose of one poison at one after-treatment temperature is determined by the length of time the wax has been saturated. They lead to the conclusion that the effect of temperature on the relative toxicity depends on the temperature coefficient of kill by internal action of the poison on the insect. This can be measured by injection tests. If it is negative or zero, the ratio of toxicities (colloid : crystals) by contact action, measured quite soon after treatment of the insects, will be greater at a low temperature after treatment than at a high one, but if the coefficient is positive, the effect of temperature on relative toxicity cannot be foretold. The experimental results seem to confirm the assumptions.

Bletchly (J. D.) & Fisher (R. C.). **Use of Gamma Radiation for the Destruction of Wood-boring Insects.**—*Nature* **179** no. 4561 p. 670, 1 ref. London, 1957.

The results are summarised of preliminary laboratory tests in Britain on the value of treatment with γ-rays against wood-boring insects. The tests were carried out on *Lyctus brunneus* (Steph.), *Anobium punctatum* (Deg.) and *Xestobium rufovillosum* Deg. removed from wood or in samples approximately ½ in. in thickness, and radioactive cobalt (^{60}Co) was used as the source of the radiation. Eggs of *Anobium* and *Xestobium* irradiated within 1–4 days of being laid were killed by exposure to a dosage of 4,000 röntgens, but the mature eggs required dosages of 48,000–68,000 and over 32,000 r., respectively; some evidence was obtained that the larvae that hatch from eggs irradiated at much lower dosages do not survive. The development of *Lyctus* larvae was arrested by treatment at 8,000 r., but high dosages were needed to produce rapid mortality; the reaction of *Anobium* larvae appeared

to be similar. Irradiation of *Lyctus* adults at dosages up to 48,000 r. did not inhibit oviposition, but no fertile eggs were laid by females of any species following irradiation of both sexes at 8,000 r. Adults of *Xestobium* remain for several months within the timber before emerging from it, and this may be of importance in relation to the period during which timber containing both adults and larvae could most effectively be irradiated. Further work with this species is in progress.

Cornwell (P. B.), Crook (L. J.) & Bull (J. O.). **Lethal and sterilizing Effects of Gamma Radiation on Insects infesting Cereal Commodities.** —*Nature* **179** no. 4561 pp. 670–672, 2 graphs, 9 refs. London, 1957.

In view of the coming availability of high-flux sources of γ-rays developed from by-products of nuclear fission, the effects of γ-radiation, which resemble those of X-rays or cathode rays [*cf. R.A.E.*, A **44** 272], on insects infesting cereal commodities were investigated in the laboratory in Britain. The tests were carried out on insects of 17 species, and a radioactive-cobalt (^{60}Co) source that provided a dose-rate of 6,000 röntgens per hour was used.

When batches of 300 adults of each of eight species were irradiated at a dose of 20,000 rep [röntgens equivalent physical], the percentage survival ten days later was 23 for *Cryptolestes* (*Laemophloeus*) *minutus* (Ol.), 71 for *Calandra oryzae* (L.), 94 for *C. granaria* (L.), and 0 for *Oryzaephilus surinamensis* (L.), as compared with 92, 98, 100 and 84, respectively, in the controls; there was no mortality among adults of *Rhizopertha dominica* (F.), *Tribolium confusum* Duv., *T. castaneum* (Hbst.) and *Cryptolestes* (*L.*) *ferrugineus* (Steph.). When the immature stages of all these species and of *Ephestia kuehniella* Zell., *E. elutella* (Hb.), *Sitotroga cerealella* (Ol.) and *Trogoderma granarium* Everts were irradiated in culture media at the same dosage, adult emergence was considerably reduced. Most of it took place within 17 days of treatment, indicating that only pupae and the older larvae were able to complete their development, and all the adults were sterile. Irradiated larvae of both species of *Ephestia* remained alive for many weeks, but failed to pupate, and larvae of *T. granarium* in irradiated cultures were still living three months after treatment. In similar tests in which the dosage was increased to 50,000 rep, development was completed only in *Calandra oryzae*, *S. cerealella* and *E. elutella*, and a mean of not more than one adult of each emerged; larvae of *Tribolium castaneum*, *O. surinamensis* and *Cryptolestes ferrugineus* remained alive for 14 days after treatment, and larvae of *E. kuehniella* and *Trogoderma granarium* had not pupated after 77 days. When adults were treated at the increased dose, complete mortality occurred in *Calandra oryzae* and *Cryptolestes minutus* after 14 days, in *O. surinamensis* in about 17 days, in *Tribolium confusum* and *Calandra granaria* in about 21 days, and in *Cryptolestes ferrugineus* in 28; mortality in *O. surinamensis*, *Calandra granaria*, and *Cryptolestes ferrugineus* reached a high level (about 98 per cent.) in 14, 17 and about 21 days, respectively. Almost 40 per cent. of the adults of *R. dominica* and 20 per cent. of those of *T. castaneum* were still alive after 28 days. Adults of all species were sterilised at this dosage.

When 100 adults of each of 13 species were irradiated at various dosages without food and then transferred to untreated culture media, the dosages necessary to produce sterility were 4,500 rep for *C. minutus* and 6,000 rep for *Calandra oryzae*, *Cryptolestes* (*L.*) *pusilloides* (Steel & Howe), *C. ferrugineus*, *C.* (*L.*) *ugandae* Steel & Howe, *R. dominica* and *Callosobruchus chinensis* (L.). After treatment at 4,500 rep, the last six species produced very few progeny. Adults of *Cryptolestes* (*L.*) *turcicus* (Grouv.), *O. mercator* (Fauv.), *O. surinamensis*, *T. confusum*, *T. castaneum*, and *Calandra granaria*

produced few progeny after treatment at 6,000 rep, and rather more after treatment at 4,500 rep. Fertility was significantly reduced in all species by irradiation at 3,000 rep. Most adults irradiated at 6,000 rep were still alive 36 days after treatment, but complete mortality of *Calandra granaria* and *C. oryzae* occurred after about 17 and 20 days, respectively. Survival in *Cryptolestes minutus* fell to rather less than 10 per cent. in about 17 days and then remained constant, and other species in which percentage survival did not exceed about 40 at the end of 36 days were *C. pusilloides*, *C. turcicus* and *R. dominica*.

Hussey (N. W.), Parr (W. J.) & Crocker (C. D.). **Effect of Temperature on the Development of** *Tetranychus telarius* **L.**—*Nature* **179** no. 4562 pp. 739–740, 4 refs. London, 1957.

In view of the importance of *Tetranychus telarius* (L.) in glasshouses and the lack of information on its rate of development in them, investigations were made by breeding from a single female of the red form and keeping the mites on French bean by a floating-disk technique at constant temperature in glass-fronted incubators with 16 hours' illumination daily from mercury-vapour lamps. The cultures were examined three times a day, only eggs laid in the previous four hours were used for obtaining development data, and larvae hatching on the same day were maintained on separate leaf disks. For females, the duration of the egg stage decreased from 5·9 days at 70°F. to 2·3 days at 95°F., and that of the larvae, protonymphs and deutonymphs together (with the resting stages) decreased from 7·4 days at 70°F. to 3·4 at 90°F. and then rose to 4·1 days at 98°F., this retardation being due apparently to the necessity for frequent transfer to fresh disks, deterioration at 95°F. being rapid. Comparable results were obtained in complete darkness, but total development was about 12 hours longer at each temperature. Males required about 0·6 day less for total development over the whole temperature range than females.

Gorlenko (M. V.), Voronkevich (I. V.) & Maksimova (T. S.). **Mutual Relations between the Onion Fly and Onion Syrphid and the Bacteria that cause Damp Rots in Plants.** [*In Russian.*]—*Zool. Zh.* **35** pt. 1 pp. 16–20, 6 refs. Moscow, 1956. (With a Summary in English, suppl. p. 4.)

Hylemyia antiqua (Mg.) and *Eumerus strigatus* (Fall.) are widely distributed in the Soviet Union, and the larvae injure onion by tunnelling and feeding in the bulbs, which generally become affected by bacterial rot. Bacteria pathogenic for plants had already been isolated from the surface of the eggs and the alimentary tracts of the adults of *H. antiqua*, and further investigations were therefore made. As a result, such bacteria were isolated from the internal parts of all stages of both species, and from the surface of the eggs and larvae. In all, 21 pathogenic strains were isolated, and most of them were identified as *Erwinia* (*Bacterium*) *carotovora*, *E.* (*B.*) *aroideae*, or related species. *E. carotovora* was the commonest in *H. antiqua*, but transitional forms between the two species predominated in *Eumerus strigatus*. The isolation of such bacteria from the internal organs of young adults of the overwintering generation of both species suggested that they overwinter within the insects [*cf. R.A.E.*, A **18** 220; **19** 88]. When surface-sterilised eggs of both species were placed on sterilised slices of onion or on slices infected by a culture of *Erwinia carotovora*, the larvae of *H. antiqua* and *Eumerus strigatus* developed more rapidly on the infected than the non-infected slices, so that the relation of the bacteria to the insects is probably symbiotic.

Mazokhin-Porshnyakov (G. A.). **Night Trapping of Insects with Mercury-vapour Lamps and Prospects of its Use in applied Entomology.** [*In Russian.*]—*Zool. Zh.* **35** pt. 2 pp. 238–244, 15 refs. Moscow, 1956.

The author discusses the use of light-traps in general and of those having mercury-vapour lamps in particular, and gives the results of field experiments in various parts of the Soviet Union in April–August 1954 with mercury-vapour light-traps. The orders and families of insects attracted are shown in a table. Insects of some families were much more attracted by white light than by ultraviolet light, and some species were attracted only at certain hours of the night. It is concluded that the use of such traps may be of advantage in applied entomology, in studies of the abundance of injurious species and even for direct control, with little harm to beneficial insects. Reference is made to the successful use of ultraviolet light-traps against *Platycdra* (*Pectinophora*) *gossypiella* (Saund.) on cotton in Egypt and the United States [*cf. R.A.E.*, A **42** 382], and a list is given of pests in the Soviet Union against which they might be used with success.

Shapiro (V. A.). **The principal Parasites of *Porthetria dispar* L. and the Prospects of using them.** [*In Russian.*]—*Zool. Zh.* **35** pt. 2 pp. 251–265, 3 graphs, 22 refs. Moscow, 1956.

Parasites and predators often play an important part in the restriction or control of outbreaks of *Lymantria* (*Porthetria*) *dispar* (L.), and investigations on the natural enemies of the moth in three separate forest regions of the Soviet Union (in the Provinces of Voronezh and Balashov and the Kubin district in Azerbaijan) were carried out between 1950 and 1953. A list is given of the 39 species of parasites, hyperparasites and predators found, showing the regions in which they occurred, and the ecology, bionomics, host preferences and effectiveness of the more important are discussed. The parasites are divided into groups according to their relation to *L. dispar*.

The first group comprises those of which the development was well synchronised with that of *L. dispar*, and the most effective of these were the Tachinids, *Phorocera silvestris* (R.-D.) and *Sturmia scutellata* (R.-D.), which occurred in all three areas. *P. silvestris* had one generation a year, oviposition beginning in May and reaching its peak at the time when the host larvae were in the later instars. The females deposit an average of 100 eggs each, with a maximum of 218 [*cf. R.A.E.*, A **27** 581], and the eggs were generally laid singly on the dorsal side of the thoracic segments of individuals in the third or fourth instar. The parasite larvae completed their development just before pupation of the host larvae, or rarely in the pupae, and the puparia overwintered in the soil from July to May. Shaded areas were preferred, about 49 per cent. of the host larvae being parasitised in dense stands and about 14 per cent. in widely spaced stands. The rate of parasitism never exceeded 50 per cent., even during outbreaks, and this is attributed to the low rate of reproduction of the parasite as compared with that of *L. dispar* and to high mortality due to predators and adverse weather conditions during winter. *L. dispar* was its only host.

S. scutellata also has one generation a year, the adults generally emerging at the beginning of May. Oviposition began in early June, when the host larvae were in the fourth–sixth instars, and reached its peak in mid-June. According to the literature, the females lay up to 5,000 eggs each, on the edges of the leaves, and they are ingested by the host larvae. The parasite larvae complete their development in the host pupae, and the puparia overwinter in the soil. *L. dispar* and *Dendrolimus pini* (L.) were its main hosts, some other species showing resistance to parasitism by it. It was adapted to a great variety of ecological conditions, and the percentage

parasitism sometimes reached 90 or more, but mortality was high, owing to adverse winter conditions, parasitism, and ingestion of the eggs by unsuitable insects.

The second group comprises parasites that attack a succession of host species, notably the two Braconids, *Apantelcs liparidis* (Bch.), which occurred in the first two areas, and *A. solitarius* (Ratz.), which was present in all three. In Balashov, *A. liparidis* passed through two generations on *L. dispar* in the first half of the summer and then attacked *D. pini*, in the larvae of which the parasite larvae hibernated. Its other hosts are reviewed from the literature. The females lay about 130 eggs each [*cf.* **23** 131], and the larvae of *L. dispar* were attacked in the third–sixth instars, the duration of development averaging 3–4 weeks. Depending on instar, the host larvae were parasitised by 9–40 *Apantelcs* larvae each. The latter left their hosts to pupate, and formed their cocoons on the lower parts of the trees. The distribution of *A. liparidis* was uneven, and the parasite was commonest in localities in which *D. pini* was numerous, parasitism of *L. dispar* sometimes reaching 90 per cent. in such areas. *A. solitarius* also parasitised *L. dispar* in spring, but whereas some of the second-generation larvae gave rise in midsummer to adults that oviposited on other host species, the remainder entered diapause in their cocoons and overwintered. The females lay about 400 eggs each [*cf.* **23** 619]; the first generation develop in the young *Lymantria* larvae, and the second in the older ones, only one parasite larva emerging per host. Larvae of the first generation pupated on the leaves throughout the crown, and those of the second on the leaves or in bark crevices on the trunks. The percentage parasitism varied from about 2 to 90, depending on conditions. About 20 per cent. of the population of *A. solitarius* and about 30 per cent. of *A. liparidis* were attacked by hyperparasites.

The third group comprised the parasites for which *L. dispar* served only as a secondary host and included the Tachinids, *Sturmia inconspicua* (Mg.), *Carcelia lucorum* (Mg.) and *Compsilura concinnata* (Mg.). Parasitism by the first two in Balashov and Azerbaijan, the two regions in which both occurred, did not exceed 5–7 per cent. The fourth group was also polyphagous and included *Agria* (*Pseudosarcophaga*) *affinis* (Fall.), *Sarcophaga* (*Parasarcophaga*) *dux* Thoms. vars. *harpax* Pand. and *tuberosa* Pand. and *S.* (*P.*) *uliginosa* Kram., which were present in the last two areas and numerous during outbreaks of *L. dispar*. The larvae of these Sarcophagids were deposited among the host larvae preparing for pupation and fed on both larvae and pupae, sometimes destroying 70 per cent. or more of the population.

The last group comprises hyperparasites, which sometimes killed great numbers of the primary parasites. Those reared from *Apantcles* spp. comprised *Dibrachys cavus* (Wlk.), *Hemiteles nanus* (Grav.) (*fulvipes* Grav.) and *Hemiteles* sp.; *Itoplectis alternans* (Grav.), *Theronia atalantae* (Poda) and *Brachymeria picea* Nikol'skaya emerged indiscriminately from parasitised and unparasitised pupae of *L. dispar*.

Imms (A. D.). **A general Textbook of Entomology, including the Anatomy, Physiology, Development and Classification of Insects.** Ninth edition entirely revised by O. W. Richards & R. G. Davies.—10 × 6 ins., x + 886 pp., 613 figs., many refs. London, Methuen & Co., Ltd., 1957. Price £3 15*s*.

The first edition of this well-known textbook appeared in 1925 [*R.A.E.*, A **13** 157]. Of the subsequent editions, only that published in 1934 [**22** 231] represented a substantial revision, but this has since become increasingly

out of date. The work has therefore been completely revised in the light of the literature published mainly up to 1952, and parts of it, notably those on insect physiology, extensively rewritten. References are now grouped at the end of each chapter.

Metcalf (R. L.). Ed. **Advances in Pest Control Research. Volume I.** —9¼ × 6 ins., vii + 514 pp., illus., many refs. New York & London, Interscience Publishers, Inc., 1957.

This is the first of a projected series of volumes comprising reviews of the literature on significant aspects of research connected with the control of pests, including injurious arthropods, fungi and weeds. The authors are to be selected from specialists in the various fields, and critical evaluation of new concepts and developments is to be encouraged, so that new lines of research are fostered. The articles in this first volume include: **Control of Health Hazards associated with the Use of Pesticides,** by J. M. Barnes (pp. 1–38, 136 refs.), in which the toxic properties of insecticides and the risks attending their manufacture and use are reviewed; **Uses of Radioisotopes in Pesticide Research,** by P. A. Dahm (pp. 81–146, 2 figs., 323 refs.), in which the subjects discussed include the use of labelled insecticides in research, tagging insects, mites and ticks with radioisotopes, and the control of stored-product pests by radiation effects; **The Chemistry and Action of Organic Phosphorus Insecticides,** by T. R. Fukuto (pp. 147–192, 4 graphs, 143 refs.), in which the author reviews the nature of the enzymes (esterases) inhibited by organic phosphates and the mechanisms of their reversible and irreversible inhibition, and the relation of the structure of the phosphates to their activity and their metabolism in biological systems, and concludes that organophosphorus compounds of high anticholinesterase activity may be classified as those that contain only one reactive bond connected to the phosphorus atom, or that can be metabolised by an animal or plant to give such a compound, and those that resemble the natural substrate, acetylcholine, either by their overall configuration or by the presence of a cationic site at a precise distance from the ester moiety; **The Status of Systemic Insecticides in Pest Control Practices,** by W. E. Ripper (pp. 305–352, 5 graphs, 235 refs.), in which the various ways of applying systemic insecticides, their uses for the practical control of pests and the prevention of spread of viruses by control of their insect vectors, and the selectivity of such treatments are surveyed; **Chemical Analysis of Pesticide Residues,** by M. S. Schechter & I. Hornstein (pp. 353–447, 455 refs.); and **Bioassay of Pesticide Residues,** by Yun-pei Sun (pp. 449–496, 111 refs.), in which the author reviews methods of bioassay using insects or other organisms and factors that affect the results.

Pradhan (S.) & Bhatia (S. S.). **Bioassay of Insecticides. Part V. Relative Toxicity of some important Insecticides to certain Species of Storage Pests.**—*Indian J. Ent.* **18** pt. 1 pp. 34–40, 12 refs. New Delhi, 1956.

In this fifth part of a series [*cf. R.A.E.*, A **45** 338, etc.], the results are given of comparative tests of the toxicity of DDT, γ BHC, aldrin, dieldrin, toxaphene and chlordane in impregnated dusts or emulsion deposits to adults of *Tribolium castaneum* (Hbst.), *Callosobruchus* (*Bruchus*) *chinensis* (L.) and *Calandra oryzae* (L.). The insects were dusted in petri dishes at a rate of 0·23 mg. dust per sq. cm. and left for 24 hours, or confined on a film obtained by applying 1·2 mg. emulsion spray per sq. cm. to filter paper, which was allowed to dry for two hours before use. The median lethal

concentrations were calculated from the kills given by the different concentrations used, and these showed that dieldrin, aldrin, γ BHC, chlordane and toxaphene were 11·9, 9, 3·3, 1·4 and 0·4 times as toxic as DDT to *T. castaneum* in dusts and 9·5, 26·5, 10·1, 11·9 and 1·2 times in spray deposits. The corresponding figures were 17·6, 3·5, 12·8, 1·7 and 0·38 for dusts and 11·4, 15·4, 6·9, 1·5 and 1·06 for deposits against *Callosobruchus* and 25·8, 31·7, 47·5, 9 and 0·73 for dusts against *Calandra*. The LC50's for DDT were 0·2282 and 0·4954 per cent. against *Tribolium*, 0·1475 and 0·12323 per cent. against *Callosobruchus*, and 0·9448 per cent. against *Calandra*.

In preliminary tests on larvae of *Trogoderma granarium* Everts, dusts of 5 per cent. DDT and 2·5 per cent. γ BHC or aldrin gave only 10, 20 and 26·6 per cent. mortality in 96–120 hours, and spray deposits of 2·5 per cent. DDT, γ BHC or aldrin and 2 per cent. dieldrin only 6·6, 16·6, 23·3 and 46·6 per cent. in 144 hours, indicating a high degree of resistance to insecticides in the insects. When mixed with wheat, which was then infested with larvae and stored for 103 days at about 29°C. [84·2°F.], toxaphene at 20·8–83·2 and γ BHC, aldrin and chlordane at 10·4–41·7 parts per million prevented or restricted increases in population and dieldrin at 10·4–41·7 p.p.m. permitted no increase; DDT at the same rates as toxaphene was less effective. Most of the insects were dead by the end of the period. In view of their toxicity, these insecticides should not be mixed with grain for consumption.

Siddiqi (A. A.). **Studies on the residual Toxicity of certain organic Insecticides for the Control of the Boll Weevil** (*Anthonomus grandis* **Boh.**).—*Indian J. Ent.* **18** pt. 1 pp. 45–48, 1 graph, 2 refs. New Delhi, 1956.

In tests in Louisiana, laboratory-reared adults of *Anthonomus grandis* Boh. were caged on cotton plants immediately or 24 or 48 hours after these had been sprayed, and examined for mortality 48 hours later. The results showed that applications of 0·2 lb. endrin, 2 lb. toxaphene and mixtures of 0·5 lb. DDT with 0·15 lb. dieldrin or 0·3 lb. γ BHC per acre all gave significant reductions in population. There was no significant difference between the first three in immediate or residual effect, though endrin seemed to be the most toxic, but all were significantly better than the BHC mixture in both respects.

Tirumala Rao (V.) & Raghava Rao (N.). **The Tobacco Stemborer** (*Phthorimoea heliopa* **Low.**) **in the Northern Circars: and its Control.**—*Indian J. Ent.* **18** pt. 1 pp. 49–56, 3 figs., 24 refs. New Delhi, 1956.

Gnorimoschema (*Phthorimaea*) *heliopa* (Lower) is a well-known pest of tobacco in southern India, attacking both imported and local varieties. It occurs in seed-beds and in the planted crop, and caused serious damage in the Northern Circars in 1952. The eggs are deposited on the leaves, petioles or stems of the young plants, and the larvae bore in these until they reach the main stem, where their feeding causes the development of galls. These result in stunting of the plants and the development of suckers. The full-fed larva prepares an exit hole, leaving the epidermis intact, and pupates within the gall. Control is normally effected by rejecting seedlings showing galls and by periodically inspecting the young planted crop and slitting open any galls with a sickle, which destroys the insects. Treatment of seedlings in 1950 with 2–3 applications of 0·16 per cent. wettable DDT gave good control

of an outbreak of this species and was also effective against *Prodenia litura* (F.).

In 1952, many seedlings were destroyed by disease, and attack by *G. heliopa* was heavy; seedlings were so scarce that galled ones were not rejected, and this and a dry season, favouring the increase of the borer, resulted in a serious outbreak, which threatened the entire crop. Sufficient labour was not available for slitting the galls, and the injection of 0·1 and 0·16 per cent. dilutions of 50 per cent. wettable BHC or DDT, respectively, into the galls with a 5 cc. hypodermic syringe was tested. A few drops injected at the hole prepared for exit killed the borer, and the remainder was injected from the opposite side to force the contents of the gall out through the first hole. The washing out of the gall was unnecessary, but satisfied the grower that control was being obtained. Treated plants were not adversely affected, and the leaves showed no taint. The method was cheap, rapid and effective, and over 2,000 acres of tobacco were protected by one treatment of all affected plants, sometimes amounting to 4,000 out of 6,000 plants per acre, followed by a second treatment against fresh attacks.

Naidu (M. B.) & Husain Zaheer (S.). **Physiological Action of Allethrin on Insects.**—*Indian J. Ent.* **18** pt. 1 pp. 57–62, 4 figs., 8 refs. New Delhi, 1956.

The results of studies on the physiological action of allethrin on the isolated heart of *Periplaneta americana* (L.) are given, and its action is compared with that of pyrethrum [*cf. R.A.E.*, A **43** 170] to explain why the latter is a more effective insecticide. The following is virtually the authors' summary. Allethrin at higher and at intermediate concentrations initially depresses the frequency of the heart beat but later the frequency tends to resume the normal rate. Lower concentrations cause slight initial stimulation, which is followed by a steady decline in frequency. Previous treatment with higher concentrations of allethrin abolishes the action of nicotine (5×10^{-5}) on the heart. Similarly after prolonged action with nicotine (5×10^{-5}), addition of allethrin does not produce any action on the heart. This indicates that it acts on the cardiac ganglia. Despite previous treatment with allethrin, acetylcholine still produces its stimulant action. Atropine, a cholinergic blocker in vertebrates, is shown to antagonise the action of allethrin. It is suggested that the action of allethrin is due to the release of acetylcholine at the neuro-muscular junctions. Lastly, the superiority of pyrethrum to allethrin in toxicity is shown to be due to the fact that the action of allethrin is confined to the ganglia.

Khan (M. Q.) & Murthy (D. V.). **A short Note on *Rhadinosa lebongensis* Mlk. (Hispidae: Coleoptera).**—*Indian J. Ent.* **18** pt. 1 pp. 76–77, 3 refs. New Delhi, 1956.

Small numbers of the Hispid, *Rhadinosa lebongensis* Mlk., were recently found together with *Hispa armigera* Ol. on rice in Hyderabad and caused similar damage, the adults scraping the epidermal tissues of the leaves and the larvae mining in them. Adults were also observed damaging the leaves of sugar-cane. Preliminary studies showed that *R. lebongensis* has 5–6 generations a year and that *Echinochloa colonum*, growing on the bunds of the paddy fields, is the main food-plant; larvae were also obtained from leaf mines in *Panicum* spp. The larval and pupal stages averaged 14 and 6 days, respectively, and the adults lived for 4–6 days at average minimum and

maximum temperatures of 71·9 and 84·5°F. An unidentified Chalcidoid parasitised 20–70 per cent. of the pupae.

Pradhan (S.) & Srivastava (H. M. L.). **Increased Activity of Insects associated with increased Pick-up of Insecticide at higher Temperatures.** —*Indian J. Ent.* **18** pt. 1 pp. 78–79, 1 fig., 1 ref. New Delhi, 1956.

In further investigations on the effect of temperature on the mortality of insects exposed to insecticides [*cf. R.A.E.*, A **37** 408], adults of *Tribolium castaneum* (Hbst.) were kept on DDT dust films for one day at different temperatures and then transferred to clean containers, all kept at the same temperature. The insects exposed at the higher temperatures tended to show higher mortality rates, and photographs of their tracks on the dust films indicated that increased movement at high temperatures, resulting in more frequent contact with fresh insecticidal surfaces, might contribute to this result.

Atwal (A. S.). **Influence of Temperature, Photoperiod, and Food on the Speed of Development, Longevity, Fecundity, and other Qualities of the Diamond-back Moth** *Plutella maculipennis* **(Curtis) (Lepidoptera: Tineidae).**—*Aust. J. Zool.* **3** no. 2 pp. 185–221, 4 figs., 21 refs. Melbourne, 1955.

Investigations were carried out in South Australia in which larvae of *Plutella maculipennis* (Curt.) were reared in the laboratory at different temperatures on cabbage leaves of various ages taken from plants that had been exposed during growth to photoperiods of 9 or 15 hours daylight and were themselves exposed to the same photoperiods. The following is based almost entirely on the author's summary of the results. Larvae developed more rapidly at 25°C. [77°F.] than at 18°C. [64·4°F.], but weighed less at pupation; the final ratio of dry matter to water was unaffected by temperature. The speed of development was influenced by photoperiod, and there was an indication that the influence of light was different at different temperatures. Larvae reared on white or young green leaves developed more rapidly than those reared on green but mature or senescent leaves; the slower speed of development was associated with a higher death-rate and with a lower body weight combined with a higher water content in the pupae. Irrespective of temperature and the quality of the food, females developed more slowly and, in the pupal stage, contained more dry matter and were heavier than males. Females reared at a lower temperature laid more eggs than those reared at a higher one, and this is attributed to their greater body weight. Fecundity was also affected by the photoperiod to which the insects had been exposed, but the effect was not so clear. Larvae reared on leaves exposed to a long photoperiod were more fecund on becoming adult than those reared on leaves exposed to a short one, but the difference was not quite significant. When they were reared on white or young green leaves, the larvae produced more silk, the resulting adults survived longer, the females laid significantly more eggs, and a higher proportion of the males were fertile than when they were reared on green but mature leaves. Larvae reared on leaves from plants treated with superphosphate alone or with ammonium sulphate or potassium sulphate showed higher mortality than those on leaves from untreated plants and development was slower, though not significantly so. It is concluded that a balance of nutrients is required for healthy development, reproduction and other normal activities in insects. If, through change of season or some other cause, it is upset, abnormalities may appear, such as deformities in wings and body shape, retarded development, and reduction in egg-laying capacity. Although the

behaviour and activity of *Plutella* appear well adjusted to the seasons, the heavy reductions in numbers that sometimes occur in the field [*cf. R.A.E.*, A **37** 449] indicate that they are not entirely so.

WIESMANN (R.). **Untersuchungen an den Prädatoren der Baumwollschadinsekten in Ägypten im Jahre 1951/52.** [Investigations on the Predators of the Insect Pests of Cotton in Egypt in the Year 1951–52.]—*Acta trop.* **12** no. 3 pp. 222–239, 4 figs., 2 refs. Basle, 1955. (With Summaries in French and English.)

The author reviews the principal pests of cotton in the Nile delta and gives an account of observations carried out there for a year on the arthropod predators of *Prodenia litura* (F.) and *Tetranychus telarius* (L.) (*urticae* Koch). An unsprayed cotton field was selected in 1951, and the fauna of the buds, flowers and bolls was sampled from mid-May to mid-November. The 27 arthropods found are listed, and it is shown that *P. litura* was attacked by *Coccinella undecimpunctata* L., the Staphylinid, *Paederus alfierii* Koch, three spiders and occasionally the larvae of a species of *Chrysopa*, and *T. telarius* by two unidentified species of *Scymnus*, the Anthocorid, *Orius* (*Triphleps*) *laevigatus* (Fieb.), and *Chrysopa*. *Coccinella undecimpunctata* is primarily predacious on Aphids and cannot reproduce in their absence [*cf. R.A.E.*, A **45** 168]. It attacked the eggs and young larvae of *P. litura* and was common in the early part of the season, reaching a peak in early June. As Aphids were not present on the plants, it then became much less numerous, presumably migrating in search of them. *Paederus alfierii* preyed on the eggs and newly hatched larvae of *Prodenia*, and the spiders fed on larvae in the first three instars. *Scymnus* and *O. laevigatus* were numerous in June, but disappeared after July. Supplementary observations showed that all the predators were most numerous on plants with many, well-developed inflorescences.

Since cotton is available only from March to October and the predators were not common on it in early spring or late autumn, they evidently spend much of the year on other plants. The only green crop available from October to May is berseem [*Trifolium alexandrinum*], and all the predators were found to be common on this in April–May, feeding on Aphids, *Tetranychus* or eggs or young larvae of *P. litura*. Watering of berseem after 10th May is forbidden by decree [*cf.* **18** 673], to reduce the numbers of *P. litura*, and the consequent drying up of the plants compels the predators to migrate from it to cotton, peak migration occurring in June. No reproduction of the predators, except *Chrysopa* and the spiders, was observed on cotton in 1951, and migration was renewed from mid-July to the end of August, the predators moving to growing maize. After feeding and reproducing there, they entered hibernation in December, when the maize dried up and the weather became cool and wet. The hibernation sites were not determined, but could not be found in the berseem fields.

About 10 per cent. of the egg-masses of *P. litura* on cotton were destroyed by the predators, which would be insufficient without the practice of hand-collection [*cf.* **18** 673]. They were of little value against *T. telarius*, since they left the fields in July, thus permitting mass increase of the mite, but apparently afforded some control in spring. It is concluded that the watering of berseem after 10th May forces the predators to migrate to cotton too early for maximum mite control. Were the prohibition to be lifted or postponed for a month, migration of *O. laevigatus* and the Coccinellids to cotton fields would coincide with the mass occurrence of the mite there. This would also have the advantage that the predators would not be affected by insecticides applied against *P. litura*, since treatment would already have been completed.

Bünzli (G. H.) & Büttiker (W. W.). **The Control of the Tobacco Cricket (*Brachytrupes membranaceus* Drury) in Southern Rhodesia.**—*Acta trop.* **12** no. 3 pp. 252–260, 1 fig., 19 refs. Basle, 1955.

Brachytrupes membranaceus (Dru.) is a major pest of newly planted tobacco on the sand-veldt of Southern Rhodesia [*cf. R.A.E.*, A **37** 278], cutting the leaves and stalks and storing them, together with those of other plants, in their burrows. The latter are most numerous (up to five per square yard) along the edges of long, narrow fields and on the borders and contour ridges of larger cultivated areas. Observations in 1949–52 indicated that two or more seasons with reduced rainfall favour the increase of the Gryllid, but that mortality is high during wet seasons, especially when the rains are early. Losses in stands amount to 5–30 per cent., and damage by associated pests, such as larvae of *Agrotis segetum* (Schiff.), Lamellicorns and Tenebrionids, may increase this to 10–60 per cent. The Gryllid is attacked by numerous predacious insects, of which the most important are *Chlorion xanthocerus kigonserana* (Strand) [*cf.* **23** 446], which is present from November to March, another Sphegid, *Notogonidea bembesiana* Bischoff, which attacks the young stages in April–June, and the Carabid, *Scarites natalensis* Boh. It is occasionally parasitised by the fungus, *Beauveria bassiana*, especially under moist conditions.

Control was formerly attempted by digging out the Gryllids, though excellent results were obtained on one farm prior to planting by applying 2·5 gm. potassium cyanide to the mouth of each burrow, which was then closed. The value of fumigants and other insecticides was investigated in the field in 1951. In the first test, various formulations of BHC, chlordane, parathion and DDT were poured, and two fumigants (D-D (a mixture of 1,3-dichloropropene and 1,2-dichloropropane) and ethylene dibromide) were injected, into the mouths of burrows in soil with a hard surface, on road sites and in grass-bush veldt, on 19th June, the burrows were then closed, and the number of burrows containing living Gryllids was determined on 20th September. Complete control was given only by D-D at 4 cc. per burrow. Ethylene dibromide at the same rate gave 92·6–94·4 per cent. control, and a similar order of reduction (90–96 per cent.) was given by dusts of 3 per cent. BHC or chlordane, 2 per cent. parathion, 40 per cent. wettable BHC, 50 per cent. wettable chlordane, and 25 per cent. wettable parathion, all at 1 gm. per burrow, and by suspensions of 40 per cent. wettable BHC or 50 per cent. wettable chlordane at 1 gm. in 20 cc. per burrow; 0·1 per cent. chlordane and 1 per cent. parathion in emulsions at 20–25 cc. per burrow gave 95–97 per cent. reduction. DDT in all three forms was rather less effective. In a further test on the same site on 18th July, dusts of 5 per cent. BHC, DDT, chlordane or toxaphene at about 3 gm. per burrow, applied by means of a hand blower, and calcium cyanide at 1·75 gm. per burrow, gave less than 90 per cent. control after nine weeks, but ethylene dibromide and D-D at 4 cc. were again very effective. In a third test, baits consisting of 18 lb. wheat bran with 2 lb. 5 or 10 per cent. BHC were broadcast at 20 lb. per acre, and with 3 lb. 5 or 10 per cent. BHC at 30 lb., on 23rd August, but only the highest dosage of BHC gave control that reached 40 per cent. by 1st September. This failure is attributed to the unattractiveness of the available bran and the presence of abundant alternative food. In view of the poor results, D-D and ethylene dibromide were applied on 5th September, but control 17 days later did not exceed 84 per cent.; the increasing age of the Gryllids and growing size and complexity of their burrows is thought to be responsible. Natural mortality over the test period reached 36·2 per cent. A bait consisting of lucerne soaked in an emulsion of 1 per cent. chlordane was scattered over the ridges of a plot in a heavily infested field of tobacco on 19th November, and

gave 80 per cent. control in two days and complete mortality in about three weeks. In tests on fallow land, baits prepared from old tobacco seedlings that were chopped up and dipped in an emulsion of 0·2 per cent. chlordane and broadcast or applied to mounds only, on 11th December, gave 96–98 per cent. control in nine days, and a similar bait prepared by soaking the seedlings in the chlordane emulsion for 15 minutes gave complete control of a light infestation in four days.

Dürr (H. J. R.), Joubert (C. J.) & Walters (S.). **A biological Evaluation of the Effects, two Years after Application to the Soil, of Aldrin, Chlordane and Dieldrin, on Workers of the Argentine Ant,** *Iridomyrmex humilis* **(Mayr.).**—*J. ent. Soc. S. Afr.* **18** no. 2 pp. 235–237, 3 refs. Pretoria, 1955.

Soil in vineyards at two places in South Africa that had been treated with aldrin, dieldrin or chlordane at a rate of about 2 lb. technical material per acre against *Iridomyrmex humilis* (Mayr) in April 1953 still appeared to be toxic to the ants two years later. The relative toxicity of samples of the soils, of which one was sandy and the other clay-like, was accordingly assessed in laboratory tests in which worker ants were confined for 48 hours in petri dishes containing an even, moistened layer of the air-dried soils. Mortality from all the samples was high, but that given by sandy soil treated with aldrin was significantly lower than that from the same soil treated with dieldrin or chlordane or from the clay-like soil treated with dieldrin or aldrin; the last four samples resulted in 98–100 per cent. kill. Symptoms first appeared in ants exposed to clay soil treated with dieldrin or aldrin and sandy soil treated with chlordane or aldrin after 7½, 10, 16 and 20 hours, respectively.

Smit (B.). **Pyrethrum-treated Bags for the Protection of Grain and Meal.** —*J. ent. Soc. S. Afr.* **18** no. 2 pp. 266–272, 2 pls. Pretoria, 1955.

The protection from insect attack afforded to cereals by the treatment with pyrethrum and a synergist of the bags in which they are stored was evaluated in South Africa in 1953–55. Bags made of very closely woven jute cloth that had been treated during the finishing stages of manufacture with an emulsion of pyrethrins and piperonyl butoxide to give deposits, on one side only, of 20 and 200 mg., respectively, per sq. ft. and cut in half to save space and facilitate handling, were filled with uninfested wheat, maize, wheat meal or maize meal, two half bags to each commodity, tightly sewn up, and placed on 21st June 1953 in a small room subsequently kept at a constant temperature of 80°F. and relative humidities ranging from 40 to 60 per cent., with four untreated half bags filled with the same materials. On the same day, 1,800 adults of *Ephestia kuehniella* Zell. were liberated in the room, in which were four boxes containing the same commodities to encourage breeding, and further large numbers were released during the summer, especially in December. Several hundred adults of *Calandra oryzae* (L.) were liberated in the room on 7th August 1953, and a very large population of *Tribolium confusum* Duv. quickly developed. Samples from the bags were examined on 6th May 1954, when those in the treated bags were free from infestation and those in the untreated ones were very heavily webbed by *Ephestia* but had not been attacked by *Tribolium* or *Calandra*. On 23rd December 1954, two open bags of maize infested by *C. oryzae* and *T. confusum* were placed in the room, where by 10th March 1955 very

heavy infestations of all three species had developed. On 21st May, when the room was very heavily infested by *Tribolium*, the bags were again examined and the numbers of insects present in samples (100 cc.) of the contents determined. The wheat and the maize in the treated bags were in excellent condition, though the samples from the two bags of wheat and one of the bags of maize each contained one dead adult of *Calandra*, and the sample from one of the bags of wheat also contained a living *Tribolium* adult. The meals in the treated bags were heavily infested by *Tribolium* and *Ephestia*, and both bags of maize meal and one of wheat meal were unfit for human consumption; living beetles in the maize meal were too numerous to count, and there were 76 in the sample from the wheat meal. Bread made with wheat meal from the other bag was of good texture, but had a stale flavour, which is attributed to long storage under unsuitable conditions; the sample contained six living *Tribolium* adults. The condition of the wheat and maize in the untreated bags had not changed since the previous examination, and no living insects were found in it. The wheat and maize meals had become heavily infested by *Tribolium*, and samples contained 33 and at least 28 living adults, respectively; both were unfit for human consumption.

Smith (S. G.). **A partial Breakdown of temporal and ecological Isolation between** *Choristoneura* **Species (Lepidoptera: Tortricidae).**—*Evolution* **8** no. 3 pp. 206–224, 3 graphs, 11 refs. Lancaster, Pa., 1954.

The following is largely the author's summary. Two closely related species, *Choristoneura fumiferana* (Clem.) on balsam fir [*Abies balsamea*] and *C. pinus* Freeman on jack pine [*Pinus banksiana*] in Canada, hybridise readily in captivity, but show no evidence of introgression in the field. The integrity of sympatric populations of the two insects has been attributed to ecological, temporal and sexual isolation [*cf. R.A.E.*, A **42** 220]. In 1952, a localised breakdown of the temporal barrier in north-western Ontario afforded an opportunity to assess the contributions to complete reproductive isolation made by the three components. Indices of ecological isolation, indicating the extent to which the species are confined to their specific food-plants, were calculated and found to be + 0·984 for the larvae and + 0·940 for the adults, +1 representing complete isolation and 0 no preferential feeding, and the index of temporal isolation of the adults, for which theoretical values range from +1, where unmated adults of different species do not occur together, to −1, where the emergence periods are precisely co-ordinated, was −0·590. When the numerical disproportion of the species and sexes at different periods was taken into consideration, the index of temporal isolation provided a hybrid potential of 11·5 per cent. for the field population as a whole, or 14·5 per cent. for contemporaneous unmated adults. Despite this, only conspecific unions materialised. Sexual isolation is therefore the component of reproductive isolation that renders the two species mutually exclusive genetic systems.

Webb (F. E.). **Biological Assessment of aerial Forest Spraying against the Spruce Budworm in New Brunswick. I. Timing of Operations 1952–54.**—*For. Chron.* **31** no. 4 pp. 342–352, 3 figs., 18 refs. Toronto, 1955.

The author reviews work in 1952–53 on the value of aerial sprays of DDT against *Choristoneura fumiferana* (Clem.) on balsam fir [*Abies balsamea*]

in New Brunswick [*cf. R.A.E.*, A **43** 83] and discusses the results of further tests carried out in 1954. In that year, the effectiveness of spraying on various dates was rated from the percentage reduction of the larval population and the percentage of new foliage that remained unattacked. Effectiveness was greatest (99·9 per cent.) when the spray was applied ten days after the peak of the third instar, and the limits for 90, 80, 70, 60 and 50 per cent. effectiveness would be 8–13, 11–18, 13–22, 15–26 and 17–29 days after the peak, respectively.

Prentice (R. M.). **The Life History and some Aspects of the Ecology of the Large Aspen Tortrix,** *Choristoneura conflictana* **(Wlkr.) (n. comb.) (Lepidoptera: Tortricidae).**—*Canad. Ent.* **87** no. 11 pp. 461–473, 18 figs., 15 refs. Ottawa, 1955.

Tortrix conflictana Wlk. [*cf. R.A.E.*, A **20** 225], which attacks aspen (*Populus tremuloides*) throughout the range of this tree in North America, is here transferred to *Choristoneura*, and an account is given of its life-cycle and some aspects of its ecology, based on observations in northern Manitoba and Saskatchewan in 1951–54, together with descriptions of all stages. The following is based on the author's summary of the work.

The eggs of *C. conflictana* are laid in flat clusters on the leaves between mid-June and early July, and the larvae hatch in 7–10 days. The first-instar larvae feed gregariously between the flat surfaces of leaves webbed together, attacking both epidermal layers, but damage is not conspicuous at this stage. They descend to the base of the trunk during the latter part of August, moult, and overwinter in hibernacula. The second-instar larvae resume activity in early May, ascend the trees, mine the swelling buds and feed on epidermal leaf tissue. From the latter part of the third instar until pupation, the larvae feed within rolled leaves, eating all tissues, and the heaviest defoliation occurs during this period. They pupate during the first half of June, and the adults emerge 7–14 days later. Larval populations can be estimated in spring by counting infested buds and developing leaf clusters. *C. conflictana* has an extensive complement of parasites, many of which attack other common forest insects. Those reared most commonly were *Glypta fumiferanae* (Vier.), *Apanteles* sp., *Macrocentrus iridescens* French, *Microgaster canadensis* Mues., *Zenillia* (*Eumea*) *caesar* (Aldr.), *Winthemia* (*Omotoma*) *fumiferanae* Toth. and *Actia interrupta* Curr., from the larvae, and *Itoplectis conquisitor* (Say) and *Agria* (*Pseudosarcophaga*) *affinis* (Fall.), from the pupae. Two species of ants were observed attacking the larvae. In one area, overwintering second-instar larvae were infested by *Beauveria bassiana*, but the importance of this fungus as a control factor is not known.

McMullen (L. H.), King (E. W.) & Shenefelt (R. D.). **The Oak Bark Beetle,** *Pseudopityophthorus minutissimus* **(Zimm.) (Coleoptera, Scolytidae) and its Biology in Wisconsin.**—*Canad. Ent.* **87** no. 11 pp. 491–495, 4 figs., 2 refs. Ottawa, 1955.

Insects suspected of implication in the dissemination of the oak-wilt fungus [*Endoconidiophora fagacearum*] in the United States include *Pseudopityophthorus minutissimus* (Zimm.) [*cf. R.A.E.*, A **45** 360], the bionomics of which were studied in Wisconsin in 1952–53. This Scolytid is most commonly recorded on oak (*Quercus*) but also feeds on several other trees; in Wisconsin it was observed on *Q. borealis*, *Q. ellipsoidalis* and *Q. velutina* wherever they occurred, but no other species of *Quercus* was attacked. There were

two generations a year, and only the larger larvae were found in standing trees during the winter and early spring. These gave rise to adults about 1st May in 1953, but the latter remained in the galleries for a week or more after emerging, and the emergence period continued for about two weeks. The adults fed on living tissue under cage conditions and sometimes made abortive galleries in healthy branches. The branches selected for oviposition [*cf.* **42** 99] were usually still green but likely to die within a year. The male constructs a gallery, usually beginning in a roughened or concealed area and running vertically along the surface of the xylem for about 1 cm., and the fertilised female constructs another across its centre and extending 2 cm. or more on either side of it. Eggs are deposited in niches along the sides at a rate of about two a day, and the female usually dies as soon as oviposition is completed. The number of niches in 100 galleries varied from 8 to 79 and averaged nearly 45. The larvae hatched in 4–6 days and bored with the grain of the wood, at first outside the cambium, later within it and eventually, when fully grown, along the xylem; the larval tunnels may reach 4–5 cm. in length. Pupation occurred after about 7–8 weeks. The pupal stage lasted six days, and the first-generation adults emerged after a further week (about 1st August). The cycle was then repeated, and larvae that reach the requisite size overwintered. Winter mortality was high, and further losses were caused by a fungus, a predacious mite, which attacked the immature stages and a few adults, a parasite of the genus *Ecphylus*, which is probably of negligible importance, and cannibalism among larvae where the walls between adjacent galleries had broken down.

Chant (D. A.). **Notes on Mites of the Genus** *Typhlodromus* **Scheuten, 1857 (Acarina: Laelaptidae), with Descriptions of the Males of some Species and the Female of a new Species.**—*Canad. Ent.* **87** no. 11 pp. 496–503, 4 figs., 11 refs. Ottawa, 1955.

The author shows that *Typhlodromus vitis* Oudm. [*R.A.E.*, A **18** 627; **44** 292] and *T.* (*Kampimodromus*) *elongatus* Oudm. are synonyms of *T. aberrans* Oudm., and describes the hitherto unknown males of *T. aberrans*, *T. reticulatus* Oudm. and *T. tiliarum* Oudm. from material found in south-eastern England on hazel [*Corylus avellana*], broom (*Sarothamnus scoparius*) and unsprayed apple trees, respectively, in the course of studies on mites predacious on *Metatetranychus ulmi* (Koch). He also describes the female of *T. pini*, sp. n., found under the bark of pine trees at Vancouver, British Columbia.

MacLeod (D. M.). **A fungous Enemy of the Pea Aphid,** *Macrosiphum pisi* **(Kaltenbach).**—*Canad. Ent.* **87** no. 11 pp. 503–505, 6 figs., 3 refs. Ottawa, 1955.

In 1947, large numbers of *Macrosiphum pisum* (Harris) (*pisi* (Kalt.)) on peas in the Annapolis Valley of Nova Scotia were found to be infested by a fungus identified as *Empusa aphidis*, the morphology of which is described. Mortality caused by it reached 41·1 per cent. among a collection of 3,822 Aphids, and a further 34·7 per cent. were infested. All developmental stages of the Aphid were susceptible to attack. Infested individuals became yellow-green in colour, hyphae appeared through the ventral surface about the time of death, and the Aphids then became cream or reddish-brown in colour and, sometimes, shrunken. The fungus reached epidemic proportions during 14–26th July, when the daily rainfall averaged 0·44 inch, the mean relative

humidity was 81·2 per cent., and the average maximum and minimum temperatures were 85·5 and 64·2°F., respectively. These conditions favoured rapid plant growth and reproduction of the Aphid as well as spread of the fungus. The only other Aphid found to be susceptible to it was *M. solanifolii* (Ashm.), though *Aphis pomi* Deg. is reported in the literature to be attacked. The spores may be distributed by air currents and rain, but the fungus is probably most effectively disseminated by the migration of infested Aphids.

Monteith (L. G.). **Host Preferences of *Drino bohemica* Mesn. (Diptera: Tachinidae), with particular Reference to olfactory Responses.**—*Canad. Ent.* **87** no. 12 pp. 509–530, 3 figs., 32 refs. Ottawa, 1955.

The following is based chiefly on the author's summary. Four lines of a Tachinid parasite, *Sturmia* (*Drino*) *bohemica* (Mesnil), were developed in the laboratory from a stock reared on *Neodiprion sertifer* (Geoffr.) for three generations. They were propagated by continuous breeding on *Gilpinia* (*Diprion*) *hercyniae* (Htg.), *N. lecontei* (Fitch), *N. sertifer* and *N. swainei* (Middleton) (of which the preferred food-plants are *Picea glauca*, *Pinus resinosa*, *P. sylvestris* and *P. banksiana*, respectively) and found in tests to possess varying degrees of preference for both the hosts and the food-plants of the hosts. Among the parental stock, *G. hercyniae* was the preferred host in olfactometer tests and *N. lecontei* during random assortment tests; the order of decreasing preference shown for the host food-plants was *P. resinosa*, *Picea glauca*, *Pinus sylvestris* and *P. banksiana* when they were presented alone, and *P. sylvestris*, *P. resinosa*, *P. banksiana* and *Picea glauca* when they were accompanied by host larvae of the appropriate species, and the preference for certain plants thus led to the selection of host species that were not preferred in the absence of the food-plants. Changes occurred in the degree of preference shown for the different host species by parasites of the four lines reared continuously on one. They were effected through the olfactory and chemotactic sense organs, but were not cumulative and did not persist, host species that were selected most frequently by parasites of the parental stock being also selected most frequently by individuals of subsequent generations. There was no increase in the degree of preference for the food-plant of the host on which the parasites developed. The degree of preference after exposure to a host appeared to change through a complete cycle. The degree, rate and duration of conditioning to different host species varied. Conditioning to preferred hosts became evident sooner than to non-preferred hosts, but conditioning to the latter tended to persist longer. The duration of conditioning of the chemotactile senses was different from that of the olfactory senses. Conditioning was not the result of odour contamination, habituation or associative or latent learning, and it appears unlikely to be of importance in the formation of races in *S. bohemica*.

Haynes (H. L.), Lambrech (J. A.) & Moorefield (H. H.). **Insecticidal Properties and Characteristics of 1-Naphthyl *N*-Methylcarbamate.**—*Contr. Boyce Thompson Inst.* **18** no. 11 pp. 507–513, 9 refs. Yonkers, N.Y., 1957.

The authors describe the properties of 1-naphthyl N-methylcarbamate (Sevin) and give the results of preliminary laboratory tests on its insecticidal effectiveness. It is a crystalline solid, stable under normal conditions

of storage and moderately soluble in organic solvents, but with less than 0·1 per cent. solubility in water. In the tests, it was dissolved in acetone and an alkylphenyl polyethylene glycol ether and diluted with water to the desired concentration. When detached bean leaves were dipped in the insecticide, allowed to dry and infested with larvae of *Epilachna varivestis* Muls. and *Laphygma* (*Prodenia*) *eridania* (Cram.) and plants of nasturtium (*Tropaeolum majus*) and bean, infested with *Aphis fabae* Scop. and *Tetranychus telarius* (L.), respectively, were sprayed, the compound was found to be effective against the insects, but not against the mite, the median lethal concentrations being 0·8, 10, 2 and more than 150 mg. per 100 ml., respectively. Comparison with other insecticides showed Sevin to be more effective than malathion, methoxy-DDT (methoxychlor), DDT, aldrin and toxaphene against *Epilachna* and the Aphid and more effective than the first two against *Laphygma*. Tests with plants grown in aqueous solutions of Sevin or in soil containing it showed that small quantities were translocated by the plants; control of *E. varivestis*, but not of the other insects or the mite, was obtained, and it is concluded that the compound would have little commercial value as a systemic insecticide. Coating bean seeds with a slurry of 2 lb. 50 per cent. wettable powder per 100 lb. seed appeared more promising, leaves from plants 14 days old giving complete mortality of *E. varivestis* and 50 per cent. kill of *Laphygma* larvae.

Extensive field tests were made in 34 States with Sevin in 25 and 50 per cent. wettable powders, 24 per cent. emulsion concentrates and 5 per cent. dusts, applied at 0·5–2 lb. active ingredient per acre or per 100 U.S. gals. It gave outstanding control of *Cydia* (*Carpocapsa*) *pomonella* (L.) in all tests and was effective against *C.* (*Grapholitha*) *molesta* (Busck), *Eulia* (*Argyrotaenia*) *velutinana* (Wlk.), and *Anuraphis roseus* Baker on fruit trees and *Desmia funeralis* (Hb.) on vines. It gave excellent control of *E. varivestis* in several States and showed high toxicity to *Leptinotarsa decemlineata* (Say), *Cotinis nitida* (L.), *Epitrix cucumeris* (Harris), *Heliothis zea* (Boddie), *Prodenia ornithogalli* Gn. and *Empoasca fabae* (Harris) on vegetable crops. Variable results were obtained against Coccids, the compound showing toxicity to *Coccus pseudomagnoliarum* (Kuw.) and *Aonidiella aurantii* (Mask.) but not to *Parlatoria oleae* (Colv.), and only limited activity was observed against *Musca domestica* L., mites, ants and grasshoppers.

The insecticide appeared to act primarily as an anticholinesterase. It caused no injury to bean, maize, tomato, cotton or tobacco plants when applied at the recommended doses in laboratory tests and none in wettable powders in the field; slight damage with emulsifiable concentrates was probably due to certain combinations of emulsifier and solvent. When applied as a soil drench at 25 times the dosage recommended for foliage treatment, Sevin caused slight injury to established tomato plants, slightly retarded the germination of radish seeds and severely reduced the germination of perennial rye (*Lolium perenne*). Its toxicity to mammals appeared to be low, no incompatibility with other insecticides or fungicides was observed, and its residual effect appeared to be intermediate between those of TEPP (tetraethyl pyrophosphate) and DDT.

Muesebeck (C. F. W.). **Two new Braconid Parasites of the Avocado Looper (Hymenoptera: Braconidae).**—*Pan-Pacif. Ent.* **32** no. 1 pp. 25–28, 3 figs. San Francisco, Cal., 1956.

The new Braconids described are *Meteorus tersus* and *Apanteles caberatae*, spp. n., both from adults of both sexes reared from the avocado looper, *Sabulodes caberata* Gn., in California.

Frick (K. E.). **Nearctic Species in the *Liriomyza pusilla* Complex. No. 1. Introduction (Diptera: Agromyzidae).**—*Pan-Pacif. Ent.* **32** no. 1 pp. 11–18, 4 figs., 7 refs. San Francisco, Cal., 1956. **No. 3. *L. alliovora*, new Name for the Iowa Onion Miner (Diptera: Agromyzidae).**—*J. Kans. ent. Soc.* **28** no. 3 pp. 88–92, 2 figs., 4 refs. Manhattan, Kans., 1955.

In the first of these parts of a series, the author refers to the difficulty of identifying Agromyzids of the group of *Liriomyza pusilla* (Mg.) [*cf. R.A.E.*, A **34** 57], defines the characters common to species of it, and gives lists of six North American species of *Liriomyza* that are excluded from it, showing the food-plants of the larvae and the characters that exclude them from the group, and of nine North American species included in it, showing the major differentiating characters, the known distribution of the species and the food-plants of the larvae. These latter include *L. pusilla* itself, the occurrence of which in the United States is doubtful, and *L.* (*Agromyza*) *congesta* (Beck.), which attacks various leguminous plants, *L.* (*A.*) *phaseolunata* (Frost) on lima beans, *L. propepusilla* Frost (a new name proposed by Frost in 1954 for *A. subpusilla* Frost nec Mall. [*cf. loc. cit.*]), and the species referred to below, all in the United States. Morphological characters of value in identifying species or sub-groups of the complex are described and figured.

It is stated in the other part that examination of the holotype male from Kansas and various paratypes of *L.* (*A.*) *allia* (Frost) [*loc. cit.*] showed that these differed from one another and from specimens from onion in the Iowa State College collection. *L. allia* is therefore restricted to the holotype and a topotypical male and is redescribed, and the species from onion is described from adults of both sexes as *L. alliovora*, sp. n. It is the Agromyzid recorded from onion in Iowa in 1933 [**21** 345].

Rolston (L. H.). **Insecticide Tests against the Southwestern Corn Borer (Lepidoptera: Pyralidae).**—*J. Kans. ent. Soc.* **28** no. 3 pp. 109–114, 5 refs. Manhattan, Kans., 1955.

The results are given of tests on the value of insecticides against *Zeadiatraea* (*Diatraea*) *grandiosella* (Dyar) on maize in the whorl stage in western Arkansas, a district to which this borer has recently spread [*cf. R.A.E.*, A **45** 259]. They indicated that sprays of 1 lb. EPN [O-ethyl O-p-nitrophenyl phenylphosphonothioate], 0·5 lb. isodrin or 0·25 lb. endrin per 100 U.S. gals. gave good control when applied twice, nine and 17 days after hatching, provided that sufficient spray was applied to run into the bases of the whorls, where the young larvae feed [*cf.* **45** 260]. Such treatment would not be practicable on large plants. Heptachlor was fairly effective when applied twice at 0·25 lb. per 100 U.S. gals. and gave good control when applied four times at 0·5 lb. at intervals of five days, beginning when hatching was first observed. Other insecticides in sprays gave inferior results. EPN was ineffective in a dust with cryolite, but promising in granular formulations.

Michelbacher (A. E.). **The False Spider Mite, *Brevipalpus lewisi* McGregor—a potential Pest of English Walnut (Acarina: Phytoptipalpidae).**—*Pan-Pacif. Ent.* **32** no. 2 pp. 93–94, 3 refs. San Francisco, Cal., 1956.

Brevipalpus lewisi McG., which occurs only in California and has been recorded on lemon and pomegranate there, was observed on a walnut tree

in an orchard at Linden in September 1953. It was not found in 1954, but an outbreak occurred in September 1955 over part of the orchard, causing some defoliation. The mites were very numerous on individual leaves. The damage resembled that caused by *Tetranychus pacificus* McG., which was also present together with *Metatetranychus ulmi* (Koch), but there was little or no webbing and the leaves turned a copper colour. Schradan (OMPA) and Systox [diethyl 2-(ethylthio)ethyl phosphorothioate] applied against Aphids had no effect on *B. lewisi*, and predacious insects and mites that attacked the Tetranychids afforded no control, so that *B. lewisi* was still abundant in late October, long after harvest. Overwintering adults were numerous, so that further damage was foreseen.

Rainwater (C. F.). **Bayer 17147. A promising new Insecticide for Cotton Insect Control.**—*Agric. Chem.* **11** no. 2 pp. 32–33, 107, 3 refs. Baltimore, Md., 1956.

In 1955, further extensive tests were made of Bayer 17147 (O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate) for the control of pests of cotton in the United States [*cf. R.A.E.*, A **44** 386, etc.]. It was applied in emulsion sprays and dusts at approximately 0·25–1 lb. per acre, under weather conditions favourable for the insects. At Brownsville, Texas, where infestation was very heavy, ten weekly applications of 5 per cent. dust reduced the percentage of bolls infested by the pink bollworm [*Platyedra gossypiella* (Saund.)] and the number of larvae per boll from 53·2 and 1·4 to 1·3 and 0·02, respectively, and the percentage of squares punctured by the boll weevil [*Anthonomus grandis* Boh.] from 90·6 to 14·6; they also increased the yield from 668 to 2,702 lb. seed cotton per acre and improved its quality.

Fewer details are given of the results obtained at College Station and Waco (Texas), Tallulah (Louisiana), where *A. grandis* had apparently developed resistance to chlorinated-hydrocarbon insecticides, Stoneville (Mississippi), and Florence (South Carolina), but 0·25–0·5 lb. Bayer 17147 per acre in sprays and dusts consistently gave better control of *A. grandis* than the chlorinated hydrocarbons usually recommended, kept Aphids [*Aphis gossypii* Glov.] and mites to non-injurious levels and resulted in large increases in yield. These doses did not give satisfactory control of the bollworm [*Heliothis zea* (Boddie)], and it is suggested that DDT should be added to Bayer 17147 for simultaneous control of this and the other pests.

In view of these results and earlier ones against other insects [*cf.* **44** 167], Bayer 17147 is considered promising for the control of cotton pests, but further investigations on the possibility of harmful residues on any part of the crop used to feed animals are necessary before it can be recommended. It is considered no more dangerous to apply than some other phosphorus insecticides.

Starr (D. F.). **Ryania 100% for Control of Sugarcane Borers.**—*Agric. Chem.* **11** no. 5 pp. 48–49, 51, 127, 12 refs. Baltimore, Md., 1956.

As both 5 lb. undiluted and 10 lb. 40 per cent. ryania dusts per acre have given promising control of *Diatraea saccharalis* (F.) on sugar-cane in Louisiana [*cf. R.A.E.*, A **37** 285; **38** 61], experiments were carried out in 1955 to determine whether 7 lb. undiluted ryania was equivalent to 14 lb. 40 per cent. dust. The treatments were applied by aeroplane against the third generation of the borer on five varieties of cane. Four applications were made at weekly intervals from 16th August, and the dust applied at

the low rate was readily observed on the foliage after treatment and still visible six days later. The cane was harvested on 13th–19th December, and the average yields per acre were 25·1, 24·3 and 28 tons cane and 4,320, 4,210 and 4,840 lb. sugar for no treatment and treatment with 40 and 100 per cent. ryania, respectively; the difference in sugar yield was significant for the undiluted dust only. The treatments were most effective on improved varieties of sugar-cane grown under good conditions of soil and moisture, on which they increased the yields from 28·6 to 31 and 32·7 tons cane and from 5,280 to 5,740 and 5,980 lb. sugar per acre, respectively. It is concluded that the increases in yield indicate a reasonable degree of borer control, and that the possibility of reducing the costs of the dust and its application by the use of undiluted ryania warrants wider investigation.

Foster (A. C.) & others. **Some Effects of Insecticide Spray Accumulations in Soil on Crop Plants.**—*Tech. Bull. U.S. Dep. Agric.* no. 1149, [1 +] 36 pp., 1 graph, 3 refs. Washington, D.C., 1956.

In further investigations in the United States on the possible harmful effects of residues from chlorinated-hydrocarbon insecticides in the soil [*cf. R.A.E.*, A **45** 8], repeated applications of insecticides, including the separate isomers of BHC, in wettable-powder sprays were made in 1949–54 to crops growing in various lots of soil in order to determine how fast they were likely to accumulate; this is affected by the tendency of the insecticide to decompose or volatilise before reaching the soil and to decompose in it, and by the amount removed with the harvested crops or crop residues.

Preliminary tests in greenhouse plots and cold frames at Beltsville, Maryland, showed that about 75–80 per cent. of the dieldrin, DDT, DDD (TDE), β BHC and toxaphene, 65–70 per cent. of the methoxy-DDT (methoxychlor) and δ BHC and 40 per cent. or less of the aldrin, chlordane, technical BHC, α BHC and γ BHC used each year tend to reach the soil and persist until the next. Small-grain crops were very susceptible to injury by the BHC isomers, but sorghum and maize somewhat less so; α BHC injured oats, but not rye, sorghum, maize, cotton or beans; δ BHC appeared to be the most harmful, the technical mixture and β BHC highly toxic, and γ BHC moderately toxic. Turnips grown in 1954 on previously treated plots showed no organic chlorine, snap beans none from aldrin, methoxy-DDT or γ BHC and up to 0·5 parts per million from toxaphene, DDD, dieldrin and chlordane, and garden peas 0·1–0·2 p.p.m. of the various isomers of BHC. The flavour of turnips grown in plots treated with γ BHC (purified or as commercial lindane) or technical BHC was impaired.

Cooperative tests were made in three States, mainly with aldrin, dieldrin, heptachlor, chlordane, isodrin, endrin, Dilan [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis(p-chlorophenyl)-2-nitrobutane], BHC and toxaphene, and the plants grown comprised cereals and various vegetables, including root crops, under outdoor conditions. The following is based on the authors' discussion of the results. Residues of all insecticides tended to accumulate more at Beltsville, Maryland, than at State College, Mississippi, and a little more than at New Brunswick, New Jersey. It is not known to what extent these differences were caused by differences in the soils, the climates, the time of exposure on leaf or soil surfaces before being covered with soil or the experimental procedures; each of these may have had some effect. At Beltsville, the tendency to accumulate was more marked in Congaree loam than in Chester loam, and since these tests were accompanied by no very noticeable differences in weather, it is probable that soil differences were partly responsible. It appears unsafe, therefore, to generalise from tests carried out in one district or soil. Recommended

dosages of aldrin, chlordane or heptachlor are not likely to result in total annual applications of more than 2–3 lb. per acre. At these rates and at the probable rate of disappearance from the soil found in the experiments, residues of these appear unlikely to accumulate in the soil enough to impair the growth of any of the crops included. Less is known about isodrin and endrin, but they appear more likely to accumulate; endrin appeared to do so to about the same degree as DDT under some conditions, but isodrin seemed less stable. Although soil residues of DDT present a definite risk, annual applications of isodrin and dieldrin are usually at much lower rates than those of DDT, and the residues will therefore accumulate more slowly. Dieldrin appeared more persistent than aldrin, but less so than endrin; it is also used at a very low rate. Toxaphene appeared likely to accumulate to a considerable extent. It is almost as stable as DDT and is used at much higher rates than are BHC and chlordane, so that much larger quantities may accumulate in the soil after frequent use. Even so, the residue accumulated was rarely high enough to harm unsprayed test crops.

Weight for weight, BHC was possibly the most generally harmful of the compounds tested; preparations containing large quantities of isomers other than the γ isomer may accumulate sufficiently to impair the growth of sensitive crops, but commercial lindane properly used does not appear likely to do so. Although BHC and lindane accumulate less than the other compounds studied, there is still some doubt as to the effects of soil residues on the quality of root crops.

Dutky (S. R.) & Hough (W. S.). **Note on a parasitic Nematode from Codling Moth Larvae, *Carpocapsa pomonella* (Lepidoptera, Oletheutidae).**—*Proc. ent. Soc. Wash.* **57** no. 5 p. 244. Washington, D.C., 1955.

Considerable mortality of larvae of *Cydia* (*Carpocapsa*) *pomonella* (L.) was observed on banded apple trees in an orchard in Virginia in October 1954, and examination showed that affected individuals contained nematodes of an undescribed species with a characteristically associated bacterium. In the laboratory, the nematode produced fatal infections in a wide range of insects, the species found very susceptible to it including *Galleria mellonella* (L.), *Pseudaletia unipuncta* (Haw.), *Ephestia elutella* (Hb.), *Neodiprion* sp., *Lasioderma serricorne* (F.) and *Pyrausta nubilalis* (Hb.). *Termes* sp., *Blattella germanica* (L.) and *Periplaneta americana* (L.) were less susceptible to infection, and adult honey bees were resistant to it. The nematode has been reared in large numbers in larvae of *G. mellonella*, and more than 100,000 infective-stage individuals are commonly obtained per host.

Whitcomb (W. D.). **The Grape Cane Girdler.**—*Bull. Mass.* [*agric. Exp. Sta.*] no. 484, 22 pp., 13 figs., 4 refs. Amherst, Mass., 1956.

Ampeloglypter ater Lec. is a common pest of grape vines in eastern Massachusetts, but seldom causes serious damage to the crop. The females girdle the new canes at oviposition, and the larvae bore in the canes. All stages of this weevil are described, and observations on its life-history and control are recorded. In the insectary [*cf. R.A.E.*, A **34** 52], the egg, larval, prepupal and pupal stages lasted 6–17, 14–29, 1–7 and 3–15 days, respectively, and development from egg to adult was completed in 40–68 days in the insectary and in 54–71 in the vineyard. The greatest number of eggs laid by a female was 16. The adults overwinter and there is only one generation a year.

In the field, the adults hibernate under leaves and plant débris, and resume activity about the last week in May, when the maximum temperature reaches 80°F. Eggs are laid in the canes over about five weeks, and the larvae are present for about three weeks and most abundant in early July. Pupation occurs in the canes in late July, and the adults emerge in early August, feed slightly on the petioles and tendrils, and seek hibernation quarters in early September.

Although summer pruning of infested canes reduces the weevil population, spraying gives the most satisfactory control. In tests, DDT or methoxy-DDT (methoxychlor), both with lead arsenate, or γ BHC (lindane) gave satisfactory protection, but the most effective spray was a wettable mixture of methoxy-DDT, malathion, captan [N-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide] and inert material (3:1:3:13 by weight) at 10 lb. per 100 U.S. gals. water. It should be applied in late May or early June, when activity is stimulated by higher temperatures, and repeated at intervals of 4–5 days when plant growth is rapid or the weevils abundant, though intervals of 7–9 days were satisfactory when infestation was light and the weather cool.

Wolcott (G. N.). **One-Percent Pentachlorphenol protects Wood against Dry-wood Termite Attack for more than 11 Years.**—*J. Agric. Univ. P. R.* **40** no. 1 pp. 85–86, 1 ref. Río Piedras, P.R., 1956.

A block of *Bursera simaruba* that was impregnated with 1 per cent. pentachlorophenol in January 1944 and periodically exposed to *Cryptotermes brevis* (Wlk.) in the laboratory in Porto Rico was not damaged by the termite for 11 years [*cf. R.A.E.*, A **45** 255], but was attacked late in the summer of 1955.

Lhoste (J.). **Insecticides organiques de synthèse.**—[1 +] 86 pp., multigraph. Paris, Off. Rech. sci. tech. Outre-Mer, 1957. Price *Fr.* 550.

This book consists of a classified list of about 100 synthetic organic compounds used as insecticides or acaricides, with information on their identity and chemical properties and usually also on their toxicity to arthropods, warm-blooded animals and plants, the forms in which they are available, and the rates at which they are used.

Hoyt (C. P.). **Parasites and Predators introduced into the Pacific Islands for the Biological Control of Insects and other Pests.**—*Tech. Pap. S. Pacif. Comm.* no. 101, vi + 40 pp., multigraph. Noumea, 1957.

The main part of this work comprises a list of Pacific Islands showing, for each, the insect or other pests against which parasites or predators have been introduced, their food-plants or other food, the species introduced against them, the origin of the latter, the date of the introduction, and whether it resulted in establishment. In supplementary lists, the information is arranged under the parasites or predators for each species that became established, under the pest species, and under the food-plants of the latter. The islands comprise Canton Island, the Carolines, the Cook Islands, Fiji, Guam, the Gilbert, Loyalty, Mariana and Marshall Islands, Midway, New Britain, New Caledonia, New Guinea, the New Hebrides, Pitcairn, Samoa, the Society Islands, the Solomon Islands, Tonga and Wallis.

Albrecht (F. O.). **La densité des populations et la croissance chez** *Schistocerca gregaria* **(Forsk.) et** *Nomadacris septemfasciata* **(Serv.); la mue d'ajustement.**—*J. Agric. trop. Bot. appl.* **2** no. 3–4 pp. 109–192, 26 figs., 37 refs. Paris, 1955. (With a Summary in English.)

The following is based on the author's summary. A study of development in hoppers of *Nomadacris septemfasciata* (Serv.) and *Schistocerca gregaria* (Forsk.) reared in isolation showed that there are two types, according to the size, based on weight and head width, of the hoppers on hatching. Small hoppers grow slowly and pass through seven instars, whereas large ones grow more quickly and pass through only six; the additional instar therefore compensates for the smaller original size. Within each type of development also, the growth rate is dependent on size at hatching, and is greater in small hoppers than in large ones. The type of development appears to be determined before hatching, since the number of moults to be expected can be forecast in the first instar. The number of eye stripes in the adult provides a reliable indication of the number of moults undergone. A morphological study of the wing pads and female genitalia indicated that these organs reflect differences both in size between successive instars in each type of development and in phase, but that the female genitalia are the more reliable for distinguishing instars, whereas the wing pads are good phase discriminators. The size at hatching, and consequently the type of development, is determined by the population density at which the parent female was reared; the smallest hoppers hatched from eggs laid by females kept in isolation almost all their lives, and the largest from eggs laid by females kept at high density. The discrepancy between size, estimated as head width, in the two developmental types was greatest in the early instars. A series of samples of *Nomadacris* from moderately crowded populations in the centre of the Rukwa Valley, Tanganyika, showed a progressive decline in the proportion of six-instar forms in adults of both sexes during the dry season of 1952, but it is not known whether the decline was connected with different survival or dispersal values in the two forms.

Wintrebert (D.). **La ponte et l'éclosion du criquet nomade** *Nomadacris septemfasciata* **Serv. dans la zone d'inondation du Niger (Soudan français).**—*Agron. trop.* **10** no. 5 pp. 610–615, 1 fig., 8 refs. Nogent-sur-Marne, 1955. (With Summaries in English and Spanish.)

Observations on oviposition by *Nomadacris septemfasciata* (Serv.) in the flood plains of the Niger were made in 1951 in an area in which populations and densities of this locust had been highest since 1946 [*cf. R.A.E.*, A **42** 117]. The results showed that the percentage of females that had oviposited rose from 30 on 9th July to 100 at the end of that month, and that their density fell from five to one per 100 paces in the same period, presumably owing to death following oviposition. Females in rearing cages deposited two or, in one case, three egg-pods at intervals of about a week. The eggs hatched in 22–30 days at average temperatures of 27–30°C. [80·6–86°F.], and since hatching began in the field about 26th July, oviposition evidently occurred from the end of June. The oviposition sites were of three main vegetational types. In the first, which was the commonest, the dominant plant was *Echinochloa stagnina*, which formed a thick mat of roots and stems; the others comprised small eminences with tufts of *Andropogon* and small depressions with a vegetation of *Echinochloa pyramidalis* and other plants. There were patches of bare soil in each type, but the eggs were usually laid in the vegetation. The mean number of oocytes found in 21 females dissected when ready to oviposit was 139. In two egg-pods,

hatching continued over periods of 4–5 days. High mortality among the eggs was caused by excessive soil moisture, flooding, parasitism by *Scelio sudanensis* Ferrière and attack by other natural enemies. The first-instar hoppers were attacked by many invertebrate predators and by insectivorous birds and were killed by cold and high humidity. On 29th July, a tornado completely destroyed hoppers that had hatched during the previous three days and had been so numerous as to render the development of swarms likely.

Bowden (J.). **Maize Stem Borer Control Extension Dusting Trials First and Second Seasons, 1954.**—*New Gold Cst Fmr* **1** nos. 1–2 pp. 23–26. 59–61. Accra, 1956.

Demonstrations of the effectiveness of DDT in controlling *Sesamia botanephaga* Tams & Bowden [*cf. R.A.E.*, A **41** 69] and *Busseola fusca* (Fuller) on first- and second-crop maize were made on peasant farms in three districts in the Gold Coast in 1954. In each series of trials, two applications of a 5 per cent. dust were made 14 and 28 days after sowing, at rates of 16 and 20 lb. per acre, respectively. Early maize was usually sown in the last two weeks of February and was very lightly infested. Although no increase in yield was expected as a result of treatment, one of 15·5 per cent. did in fact occur, apparently as a result of a reduction in plant mortality, which was 4 per cent. below that in untreated plots. Demonstrations on late maize, which was sown between 3rd and 10th September, were made in only two districts. Infestation was higher in one than in the other, but fairly high in both, and varied directly with plant stand. Yield from the dusted plots was increased by 24·8 per cent. at the more lightly infested place and by 35·2 per cent. at the other, and the yield per plant from 0·10 and 0·09 lb., respectively, to 0·12 lb. at both places.

Utida (S.). **Population Fluctuation in the System of Host-Parasite Interaction.**—*Mem. Coll. Agric. Kyoto* no. 71 (Ent. Ser. no. 11), 34 pp., 13 graphs, 33 refs. Kyoto, 1955.

The following is substantially the author's summary. Observations were made under controlled conditions in the laboratory on the fluctuations in numbers of *Callosobruchus chinensis* (L.) infesting azuki beans (*Phaseolus angularis*) and its parasite, *Heterospilus prosopidis* Vier., in populations of the two set up at different initial levels and maintained through 25 generations of the host. Violent fluctuations occurred in both host and parasite numbers, in cycles of about six generations of the host, and they were accompanied by fluctuations in sex ratio and average body weight of both insects. The results are given in detail and discussed in relation to the simultaneous equations describing the effects of population densities on the rates of reproduction [*cf. R.A.E.*, A **21** 369].

Papers noticed by Title only.

Hartwig (E. K.). **The Determination of the Population Distribution in *Trinervitermes* Nests** [in grass veldt in the Orange Free State] **as a Basis for Control Measures.**—*Boll. Lab. Zool. Portici* **33** pp. 629–639, 7 figs., 1 ref. Portici, 1956. [For fuller account see *R.A.E.*, A **45** 117.]

Yasumatsu (K.). **A revised List of the known Hymenopterous Parasites of the Scales of the Genus *Ceroplastes*.**—*Boll. Lab. Zool. Portici* **33** pp. 708–717, 30 refs. Portici, 1956. [*Cf. R.A.E.*, A **40** 249.]

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